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U.S. COAST GUARD SAFE LOADING STANDARD TEST PROCEDURE.(U)
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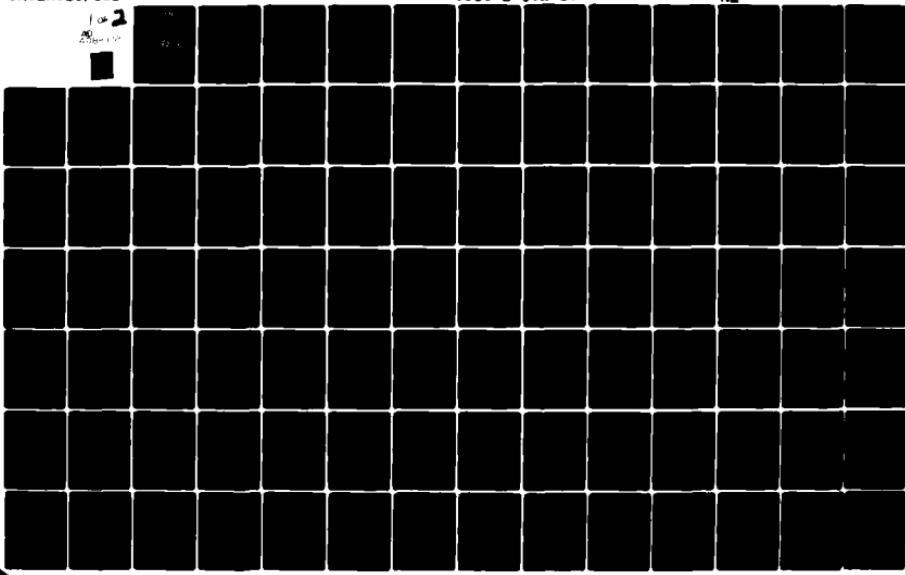
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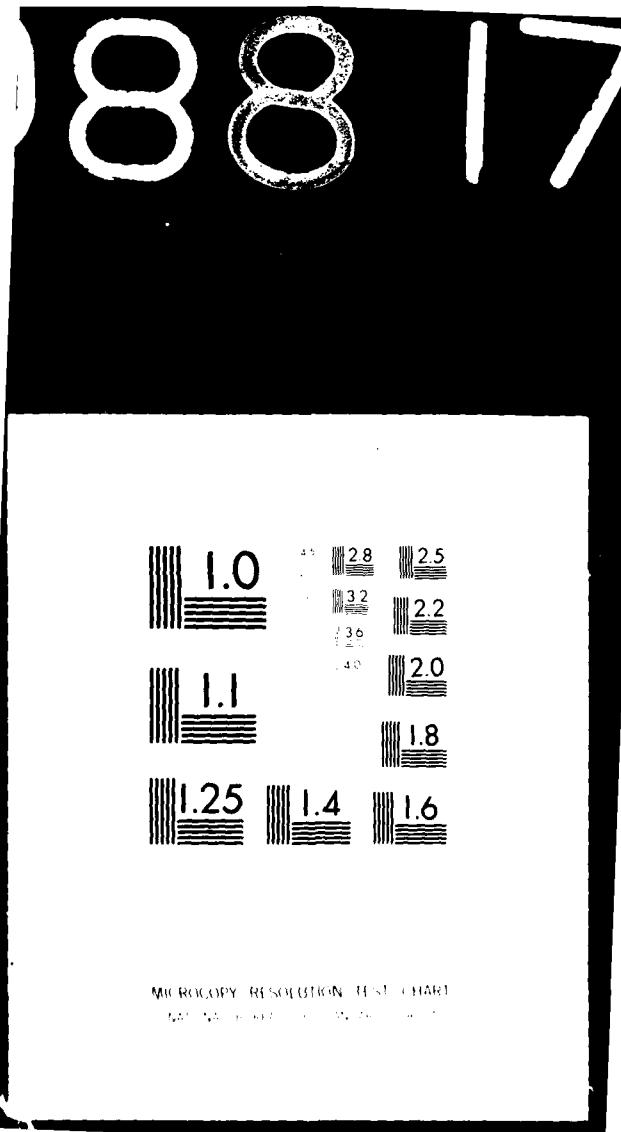
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REPORT NO.

CG-B-002-80

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SAFE LOADING STANDARD TEST PROCEDURE

U. S. Coast Guard Office of Boating, Public and Consumer Affairs
Boating Technical Division
2100 Second Street SW
Washington, D. C. 20593



June 1980

Final Report

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PREPARED FOR
U.S. DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD
WASHINGTON, D.C. 20593

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Technical Report Documentation Page

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14. Sponsoring Agency Code U. S. Coast Guard (G-BBT)		
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16. Abstract This report describes in detail a Safe Loading Standard Test Procedure for outboard boats, inboard boats, inboard/outdrive boats and boats without mechanical propulsion. The Safe Loading Standard Test Procedure is designed to determine whether or not a given boat meets the safe loading requirements outlined in the Federal Boat Safety Act of 1971 (P. L. 92-75) and the rules and regulations in the Federal Register: 37 FR 15782, Aug. 4, 1972, as amended at 39 FR 10899, Mar. 22, 1974; 40 FR 33973, Aug. 13, 1975; 40 FR 43657, Sept. 23, 1975; 40 FR 51440, Nov. 5, 1975; 42 FR 2681, Jan. 13, 1977. Basically, the Safe Loading Standard Test Procedure establishes, by testing in a water tank, the Maximum Weight Capacity and the Maximum Persons Capacity for outboard boats, inboard boats, inboard/outdrive boats and boats without mechanical propulsion. This test procedure was developed after evaluating various test methods for determining the Maximum Weight Capacity and Maximum Persons Capacity.		
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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
			<u>LENGTH</u>	
inches	1.00		centimeters	cm
feet	.30		centimeters	cm
yards	.09		centimeters	cm
miles	.16		kilometers	km
acres				
			<u>AREA</u>	
square inches	6.5		square centimeters	cm ²
square feet	.09		square meters	m ²
square yards	.03		square meters	m ²
square miles	.25		square kilometers	km ²
acres	.04		hectares	ha
			<u>MASS (weight)</u>	
ounces	.28		grams	g
pounds	.45		kilograms	kg
short tons	.95		tonnes	t
(2000 lb)				
			<u>VOLUME</u>	
teaspoons	.6		milliliters	ml
tablespoons	1.5		milliliters	ml
fluid ounces	.30		milliliters	ml
cups	.074		liters	l
pints	.47		liters	l
quarts	.95		liters	l
gallons	1.8		cubic meters	m ³
cubic feet	0.03		cubic meters	m ³
cubic yards	.076		cubic meters	m ³
			<u>TEMPERATURE (Farenheit)</u>	
Farenheit	5/9 lesser	Celsius		
temperature	32°	temperature		

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
			<u>LENGTH</u>	
inches	.025		centimeters	cm
feet	.33		centimeters	cm
yards	.93		centimeters	cm
miles	.0016		kilometers	km
acres				
			<u>AREA</u>	
square inches	.016		square centimeters	cm ²
square feet	.12		square meters	m ²
square yards	.04		square meters	m ²
square miles	.25		square kilometers	km ²
acres	.0016		hectares	ha
			<u>MASS (weight)</u>	
grams	.001		ounces	oz
kilograms	.22		pounds	lb
tonnes (1000 kg)	1.1		short tons	t
			<u>VOLUME</u>	
milliliters	.001		fluid ounces	fl oz
liters	.21		quarts	qt
liters	1.06		gallons	gal
cubic meters	.035		cubic feet	cu ft
cubic meters	1.3		cubic yards	cu yd
			<u>TEMPERATURE (Celsius)</u>	
Celsius	5/9 (less)	Farenheit		
temperature	32°	temperature		

1 in = 2.54 centimeters. For other exact conversions, and more detailed tables, see NBS Handbook 75, "Tables of Weights and Measures," Price 35 cents, 30 Centavo, No. C-310-206.

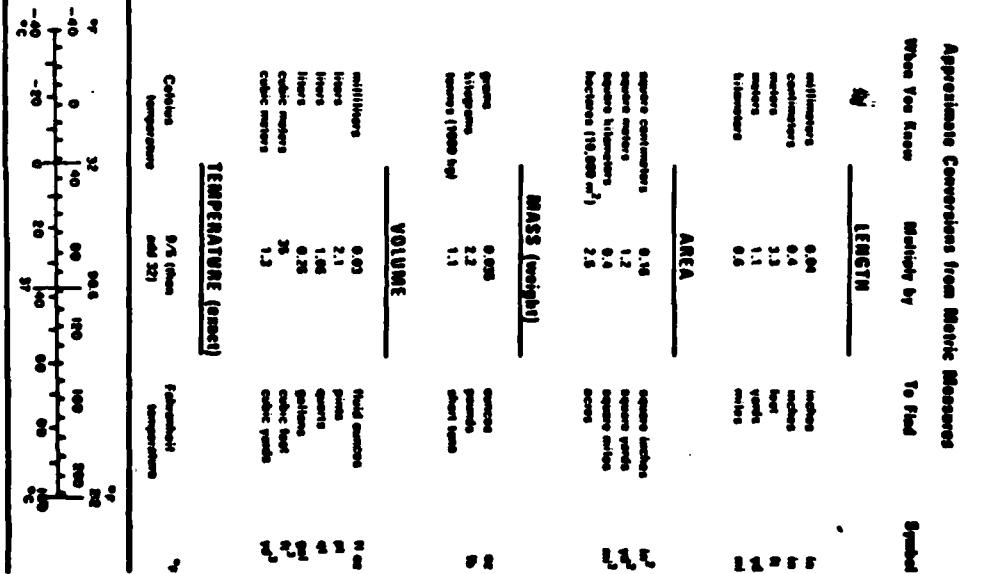


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Accession For	
NTIS GRA&I	<input checked="" type="checkbox"/>
DDC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By _____	
Distribution/	
Availability S	
Dist	Avail. or special
A	

1.0 SCOPE

1.1 Applicability of Federal Boat Safety Act

The boating safety regulations apply to boats and associated equipment which fall within the scope of the Federal Boat Safety Act of 1971. Boats include any vessel:

- a. Manufactured or used primarily for non-commercial use, or
- b. Leased, rented or chartered to another for the latter's non-commercial use, or
- c. Engaged in the carrying of six or fewer passengers.

1.2 Exceptions

The Federal Boat Safety Act of 1971 applies to all boats used on waters subjected to the jurisdiction of the United States and on the high seas beyond the territorial seas for vessels owned in the United States except:

- a. Foreign vessels temporarily using waters subject to United States jurisdiction.
- b. Military or non-recreational public vessels of the United States.
- c. Ships' lifeboats.
- d. A vessel whose owner is a state or subdivision thereof, which is used principally for governmental purposes and which is clearly identifiable as such.

1.3 Applicability of Safe Loading Performance Standard

The Safe Loading Standard and amendments thereto (Appendix A) applies to all conventional general purpose boats less than 20 feet in length, the hull of which is begun after 31 October 1972, except sailboats, inflatables, canoes, and kayaks. For the purposes of this part, the term "conventional general purpose boats" includes monohull displacement or planing boats designed or intended to be propelled or controlled by oars, paddles, poles, mechanically driven water jets or submerged propellers, and capable of transporting at least one person clear of surface water.

1.4 Minimum Requirements

The requirements included herein for safe loading of boats are the minimum requirements for conformance within the jurisdiction of the Federal Boat Safety Act of 1971. It must be recognized that such safe load capacities are predicated upon operation in calm water and do not necessarily represent the most adverse case.

2.0 PURPOSE

2.1 The USCG Safe Loading Performance Standard establishes the requirements for maximum safe load capacities for boats and establishes how these capacities are to be determined. The purpose of this test procedure is to specify the methods, equipment, and tolerances to be employed in determining conformance of applicable boats to the Performance Standard requirements.

3.0 GLOSSARY AND SYMBOLS

3.1 Glossary -

Aft - At, near, or toward the stern.

Amidships - The center of the boat, with reference to length.

Athwart - Across the boat's keel line at right angles.

Beam - The transverse distance between the outer sides of the boat excluding handles, and other similar fittings, attachments and extensions.

Boat Weight (H) - The combined weight in pounds of the boat hull and all its permanent appurtenances, (excluding outboard motor(s) weight in outboard boats) deck and superstructure weight, weight of full permanent fuel tanks.

Bow - The forward part of the boat.

Displacement (D) - The volume of water, in pounds, displaced by the boat at its maximum level immersion in calm water.

Freeboard - The vertical distance from the lowest point of major water ingress along the side of the boat to the waterline.

Full Transom - A transom with a maximum width which exceeds one-half the maximum beam of the boat.

Horizontal Boat - A boat is horizontal when it is transversely level and when the lowest points at the 40% and 75% of the boat's length behind the most forward point of the boat are level.

Hull - The main body of a boat.

Keel - The backbone of a boat from which rise the frames, stem, etc., or in the absence of a structural backbone, the lowest part of the hull along the centerline.

Length - The straight line horizontal measurement of the overall length from the foremost part of the horizontal boat to the aftermost part of the boat, measured from end-to-end excluding sheer, and measured on the centerline. Does not include bow sprits, bumpkins, rudders, outboard motor brackets, handles, or other such fittings, attachments or extensions.

Level Immersion - A boat is immersed level when it is transversely level and when either of the two following conditions are met:

- i) The forward point where the sheer intersects the vertical centerline plane and the aft point where the sheer intersects the upper boundary of the transom (stern) are equidistant above the water surface or are equidistant below the water surface.
- ii) The most forward point of the boat is level with or above the lowest point of water ingress.

List - The inclination of a vessel to either side.

Machinery Weight (M) - The combined weight of the motor(s) or installed engine(s), drive unit, batteries, and control equipment.

Maximum Persons Capacity (P) - The maximum live load weight, in pounds (as determined by the procedure herein), which is allowed by the Safe Loading Standard.

Maximum Weight Capacity (W) - The maximum weight, in pounds (as determined by the procedure herein), which is allowed by the Safe Loading Standard.

Monohull Boat - A boat on which the line of intersection of the water surface and the boat at any operating draft forms a single closed curve (catamarans, trimarans, and pontoon boats are not monohull boats).

Permanent Appurtenances - Means equipment mounted or fastened, so that it is not removable without the use of tools. Seats, inboard engines, windshields, helm stations, or hardtops are permanent appurtenances. Outboard motors, controls, batteries, and portable fuel tanks are not permanent appurtenances.

Sheer - The topmost line in a boat's side. The sheer intersects the vertical centerline plane of the boat at the forward end and intersects the transom (stern) at the aft end. For the purposes of this definition, the topmost line in a boat's side is the line defined by a series of points of contact with the boat structure, by straight lines at 45° angles to the horizontal and contained in a vertical plane normal to the outside edge of the boat as seen from above and which are brought into contact with the outside of the horizontal boat (see "Horizontal Boat").

Stem - The foremost upright structural member attached to the keel of the boat.

Stern - The after end of the boat.

Transom - The surface at the stern of a boat projecting or facing aft. The upper boundary of the transom is the line defined by a series of points of contact, with the boat structure, by straight lines at 45°

angles to the horizontal and contained in a vertical longitudinal plane and which are brought into contact with the stern of the horizontal boat (see "Horizontal Boat").

3.2 Symbols

A = Total Test Weight
D = Displacement
H = Boat Weight
 L_1 = Centerline Length, Longer Passenger Compartment
 L_s = Centerline Length, Shorter Passenger Compartment
LLC = Live Load Capacity
M = Machinery Weight
MTL = Maximum Test Live Load
MTW = Maximum Test Weight
P. = Maximum Allowable Persons Capacity
 P_m = Manufacturer's Maximum Persons Capacity
 P_1 = Maximum Persons Capacity (W Method, or Boats Manually Propelled)
 P_2 = Maximum Persons Capacity (LLC Method, or Boats Rated for 2 Horsepower or Less)
 T_1 = Total Test Weight, Longer Passenger Compartment
 T_s = Total Test Weight, Shorter Passenger Compartment
W = Maximum Weight Capacity
 W_d = Maximum Weight Capacity (Displacement Method)
 W_m = Manufacturer's Maximum Weight Capacity

4.0

TEST PROCEDURE

This procedure includes a description of the test boat, the test sequence and conditions under which the tests shall be performed. It also contains a receiving inspection routine common to all types of boats. Displacement and Live Load Test procedures for each of three types of boats are presented separately. Finally, a section on test records and reports common to all types of boats is given.

4.1

Description of Test Boat and Test Sequence

4.1.1

Test Boat Description - The test boat shall consist of one complete hull as delivered by the manufacturer including all its original and permanent appurtenances including machinery or a suitable substitute thereof.

4.1.1.1

Permanent Appurtenances - Equipment shall be considered "permanent" if it is normally left aboard while the boat is docked and not in use. Examples of permanent appurtenances include convertible tops, fish-finders, compasses, permanently installed steering gear, etc. Examples of gear that shall not be considered permanent include ice chests, deck chairs, baggage, outboard motors, controls, batteries, portable fuel tanks, etc. (See Definitions)

4.1.1.2

Machinery Weight - Machinery weight is the combined weight of the installed motor(s) or engine(s), drive unit, batteries, and control equipment. All machinery shall be in its normal operating position.

a. Inboard and Sterndrive Machinery - Inboard and sterndrive machinery shall be that installed in the boat by the manufacturer.

b. Outboard Machinery - All test boats designed for outboard motors shall be equipped with substitute dummy motors with a weight corresponding to the weight of a motor of maximum recommended horsepower as specified on the capacity plate. If no maximum recommended horsepower is given by the manufacturer's capacity markings, the test agency shall contact the Coast Guard for direction.

4.1.2

Test Sequence - The complete test boat as described in Paragraph 4.1.1 above shall be subjected to test in the sequence listed below.

TestReceiving InspectionDisplacement TestLive Load Capacity Test, for Outboard Boats Rated for Greater than 2 Horsepower and Inboard, I/O boats.

4.2 Test Conditions

4.2.1 Ambient Conditions - Immediately prior to the performance of each test, the ambient temperature, relative humidity, and barometric pressure shall be documented in the space provided on the top of the appropriate Safe Loading Test Data Sheet.

4.2.2 Test Article Identification - The test boat shall be identified immediately upon receipt at the test laboratory. This identification shall include marking the vessel with a test article number in a manner which will not allow obliteration during the testing process. Upon assignment, the test article number shall be entered on Data Sheet No.1 along with brand name, model name, model number, and serial number of the vessel. The boat shall be photographed as described below.

- a. An external bow-on view.
- b. An external transom view.
- c. An external side view.
- d. A close-up of the manufacturer's display of capacity markings including a six-inch scale taped along side the plate to illustrate size of plate and lettering.

Each photograph shall include the test article number lettered against a contrasting background. The letters shall be of sufficient size and boldness to be readable from a 5" x 7" photograph (two inches minimum for overall views and smaller for close-ups).

4.2.3 Test Article Storage and Handling

4.2.3.1 Storage Area - A suitable storage area shall be maintained in accordance with good housekeeping practices in which the test article will be stored during all non-testing periods.

4.2.3.2 Lifting - Lifting slings shall be provided by the test laboratory for use in lifting the boat into and out of the flotation facility. The lifting slings shall protect the boat from handling damage.

4.2.4 Calibration

4.2.4.1 Requirement - In order to verify that boats and associated equipment meet certain minimum requirements, it is mandatory that the instrumentation and test equipment used to verify these requirements also meet certain minimum standards. Therefore, an instrumentation and test equipment calibration system shall be implemented by the test laboratories performing Boating Safety Standard Compliance Testing.

4.2.4.2 System Standards - Laboratories which already have an instrumentation and test equipment calibration system shall insure that the minimum requirements as set forth in Paragraph 4.2.4.3 are met. Those laboratories which do not have such a system are referred to MIL-C-45662A, "Calibration System Requirements" and MIL-HDBK-52, "Evaluation of Contractor's Calibration System". These references provide for the establishment and maintenance of a calibration system which will control the accuracy of instrumentation and test equipment.

4.2.4.3 System Description - The calibration system shall include as a minimum:

- a. Standards for calibrating the equipment which will control the test quality shall have the capabilities for accuracy, stability and range required for the intended use.
- b. The standard shall be maintained and used in a controlled environment to insure continued measurements of required accuracy giving due consideration to temperature, humidity, vibration, cleanliness, and other controllable factors affecting precision measurements.
- c. Instrumentation, test equipment, and calibration standards shall be calibrated at periodic intervals established on the basis of stability, purpose and degree of usage. In no case shall the interval of calibration be longer than one year.
- d. Written procedures shall be prepared or provided and utilized for calibration of all instrumentation, test equipment, and measurement standards used to assure the accuracy of measurements involved in establishing product conformance. The procedures may be a compilation of published standard practices or manufacturer's written instructions and need not be rewritten to satisfy the requirements of this test procedure. The calibration process shall require that calibration be performed by comparison with higher accuracy level standards.
- e. Instrumentation and test equipment shall be calibrated by the contractor or a commercial facility utilizing reference standards (or interim standards) whose calibrations are certified as being traceable to the National Bureau of Standards. Reference standards requiring calibration by a higher level Standards Laboratory shall be calibrated by a commercial facility capable of providing the required service or by the National Bureau of Standards. All reference standards used in the calibration system shall be supported by certificates, reports or data sheets attesting to the date, accuracy and conditions under which the results furnished were obtained. The contractor shall be responsible for assuring that the sources providing calibration services, other than the National Bureau of Standards, are in fact capable of performing the required service to the satisfaction of this specification. All certificates and reports shall be available for inspection by authorized Coast Guard representatives.

- f. The application of the above requirements will be supported by records designed to assure that established schedules and procedures are followed to maintain the accuracy of all instrumentation and test equipment and supporting standards. The records shall include a suitably identified individual record of calibration or other means of control for each item of instrumentation and test equipment and measurement standards providing calibration interval and date of certification of results of last calibration.
- g. Instrumentation, test equipment and measurement standards shall be labeled to indicate the date of last calibration, by whom it was calibrated, and when the next calibration is due.
- h. The test agency shall be responsible for assuring that his subcontractors have a calibration system which essentially meets the requirements of this specification.

4.2.4.4 Verification - All operations performed by the laboratory in compliance with this test procedure will be subject to USCG verification at unscheduled intervals. Verification will include, but not be limited to, the following:

- a. Surveillance of calibration operation for conformance to the established system.
- b. Review of calibration results as necessary to assure accuracy of the system.

4.2.5 Test Article Non-Conformance

4.2.5.1 Non-Conformance Conditions - The following conditions shall be classified as a non-conformance:

- a. Any measurement which is not within the limits specified by the applicable test specification when the applied inputs and environmental levels are within tolerance.

b. Any damage or deterioration resulting from testing which prevents the test specimen from meeting the specification requirements.

4.2.5.2 Notice of Non-Conformance - A formal Notice of Non-Conformance shall be made to the USCG Contract Monitor within a period of three working days after occurrence. The methods for notification are specified in Paragraph 5.2.1 herein.

4.3 Receiving Inspection

4.3.1 Requirements

A receiving inspection shall always be performed prior to any testing. This inspection is designed to check for poor workmanship, shipping damage and conformity with manufacturer's furnished documentation and maintenance manuals. Photographs of any defects or imperfections shall be taken and included in the test report.

4.3.2 Methods

4.3.2.1 Identification - Verify that the boat has been properly identified in accordance with Paragraph 4.2.2. Complete applicable portions of Data Sheet No. 1 -- Receiving Inspection.

4.3.2.2 Inventory - Inventory all machinery and other gear and enter with model numbers when available on Data Sheet No. 1. This inventory shall include engines, outdrives, fuel tanks, controls, navigation equipment, electronic equipment, lifesaving equipment, batteries, fire extinguishers, anchors, etc.

4.3.2.3 Visual Inspection - Visually and manually inspect the boat for structural soundness such as dents, abrasions, loose or missing screws, etc., and functional characteristics. Record all deficiencies on Data Sheet No. 1. Note particularly any areas which might be subject to damage by loading such as decked over areas, hatch and engine covers, fuel tanks, etc. Record and photograph any evidence of prior structural damage that might affect the test results.

4.3.3 Equipment

No special equipment or instrumentation is required for this inspection except a camera and sufficient lighting to produce photographs which clearly depict the condition of the boat prior to testing.

4.4 Safe Loading Tests - Outboard Boats Rated for Motors Greater Than 2 Horsepower

4.4.1 Requirements

4.4.1.1 Maximum Weight Capacity (W)

The Maximum Weight Capacity marked on boats designed or intended to be propelled by outboard motors of greater than 2 horsepower must not exceed one-fifth of the difference between the boat's Maximum Displacement and the Boat Weight where:

- a. "Boat Weight" means the combined weight of the boat hull, deck and superstructure weight and all its original and permanent appurtenances; including permanently installed full fuel tanks, and permanently installed steering gear; and
- b. "Maximum Displacement" means the weight of the volume of water expressed in pounds, displaced by the boat at its maximum level immersion in calm water without ingress of water. For this purpose, one opening in the motor well to accommodate outboard motor controls or fuel lines, with its greatest dimension not over three inches, is not considered a point of major ingress of water, and shall be sealed over for this test.

Also for this purpose a boat is considered level when it is transversely level and when either of the two following conditions are met:

- (i) The forward point where the sheer intersects the vertical centerline plane and the aft point where the sheer intersects the upper boundary of the transom (stern) are equidistant above the water surface or are equidistant below the water surface.

(ii) The forward most point of the boat is level with or above the lowest point of water ingress.

4.4.1.2

Maximum Persons Capacity (P)

Except as provided for in Paragraph 4.4.1.3 below, the Maximum Persons Capacity marked on boats designed or intended to be propelled by outboard motors greater than 2 horsepower must be expressed in pounds and must not be greater than the lesser of P_1 or P_2 as determined below.

P_1 = Maximum Weight Capacity (W) where:

W = "Maximum Weight Capacity" as defined in Paragraph 4.4.2.6 minus the motor and control weight, battery weight (dry) and full portable fuel tank weight from the table on page 12a.

P_2 = Live Load Capacity (LLC) where:

"Live Load Capacity" is determined from the following test:

1. Float the boat, with all its original and permanent appurtenances in calm water.
2. Add, in normal operating positions, the total weight of motor and related equipment as shown in the table in Paragraph 4.4.2.12 for the maximum horsepower capacity marked on the boat.
3. Gradually add additional off-center weights equally distributed along one outboard extremity of the passenger carrying area at the height of the seat nearest to the center of the area, and distributed equally forward and aft of that center in a plane parallel to the floorboards, until the boat assumes a list or trim, or both, just short of allowing water to come aboard. If the boat has more than one passenger carrying area, distribute the weights in proportion to the centerline length of the passenger areas. If the seats are above the gunwale, the center of gravity of the weights shall be placed at the height of the gunwale amidships.

Table - WEIGHTS OF OUTBOARD MOTOR AND RELATED EQUIPMENT
FOR VARIOUS BOAT HORSEPOWER RATINGS

Boat Horsepower Rating	Motor and Control weight		Battery Weight		Full Portable Fuel Tank Weight		1+3+5
	Dry	Swamped	Dry	Submerged	Dry	Submerged	
1	2	3	4	5	6	7	8
0.1 to 2	25	20	-	-	-	-	25
2.1 to 3.9	35	30	-	-	-	-	35
4.0 to 7.0	55	48	-	-	-	-	80
7.1 to 15.0	75	65	20	11	50	50	145
15.1 to 25	100	88	45	25	50	50	195
25.1 to 45	155	135	45	25	100	100	300
45.1 to 80	240	210	45	25	100	100	385
80.1 to 150	315	275	45	25	100	100	460
150.1 to 250	420	300	45	25	100	100	565
TRANSOMS DESIGNED FOR TWIN MOTORS							
50.1 to 90	-	310	270	90	50	100	500
90.1 to 160	-	480	420	90	50	100	670
160.1 to 300	-	630	550	90	50	100	820

The Live Load Capacity is $A/0.6$, where A is the total of the additional off-center weights added in Step 3 above.

4.4.1.3

Maximum Persons Capacity Exceptions (For Boats Assembled or Under Construction Before 1 August 1973) --

The Maximum Persons Capacity marked on a boat may exceed the Live Load Capacity, but not the Maximum Weight Capacity (W), provided the boat is also marked as follows:

- a. At least two waterproof labels permanently affixed so as to be conspicuous and readable from any normal boarding position.
- b. Each label consisting of a plan view of the boat and the words in block letters in the sizes shown in Figure 1, in colors that contrast with the background of the label.

4.4.1.4

Persons Capacity in Whole Numbers of Persons

See Sections 183.39, 183.41 and 183.43 in Subpart C at the end of this test procedure.

4.4.2.1

Dimensional Measurement

- a. Place the boat on a boat trailer or chocks on a flat floor and trim the boat until the lowest point on the boat which is 40% of the boat's length aft of the forward most point on the boat is level with the lowest point on the boat which is 75% of the boat's length aft of the forward most point on the boat. (Refer to Figure 2.)
* NOTE: Concrete floors are normally flat to within 1/4 inch. Flatness may be verified by use of a surveyor's level and rod placed on a two-foot grid pattern.
- b. Level the boat transversely by trimming it from side to side until corresponding points at either side of the transom are equal distance from the floor.
- c. Drop a plumb bob to the floor from the most forward part of the boat on centerline. Similarly, drop a plumb bob at the aftermost part of the boat on centerline. Using a tape, measure the boat length (L) between the plumb bobs at the floor and record this value on Line 2 of Data Sheet No. 2.

* NOTE: If either the most forward point or aftermost point of the boat does not fall on centerline, use a string or straight edge to span the gap so that "L" represents the true maximum length as seen in profile.

d. Check that length (L) is less than twenty (20) feet. If "L" equals or is greater than twenty (20) feet, terminate testing to the Safe Loading standard.

e. Locate the point where the sheer intersects the vertical centerline plane of the boat at the forward end. Place the 45° indicating instrument in a vertical longitudinal plane on the boat's centerline and bring it into contact with the boat at the bow. Mark this point "S" (see Figure 2).

* NOTE: If the sheer intersects the vertical centerline plane of the boat at more than one point, the highest point of intersection will be marked as Point "S".

f. Place the 45° indicating instrument in a series of vertical longitudinal planes across the boat's transom (stern) bringing the instrument into contact with the boat's transom (stern). Mark these points along the upper boundary of the transom (stern).

Mark Point(s) "T" at the intersection(s) of the sheer with the upper boundary of the transom.

* NOTE: If the sheer intersects the upper boundary of either side of the transom at more than one point, the highest point of intersection will be marked as "T".

g. Seal minor leaks with waterproof tape or other suitable sealing media. Minor leaks include the hull/deck junction, handles, rivet holes, lifting eyes, etc. Vent holes shall not be sealed. Where controls pass through the hull or deck and a sealing boot is provided, minor leaks in the boot(s) shall be sealed. For outboard boats, one such motor well opening may be sealed when no boot is installed, provided its greatest dimension is not over three (3) inches and its purpose is for motor controls or fuel lines. Record any difficulties encountered in sealing the boat on Line 39 of Data Sheet No. 2.

* NOTE: Boats which are designed to be self-bailing shall have the self-bailing scuppers sealed prior to testing, regardless of the size of the openings.

4.4.2.2

Boat Weight

- a. Boat Weight (H') is the combined weight, in pounds, of the boat hull, deck, superstructure and its original and permanent appurtenances. Full permanent built-in fuel tanks, and permanently installed steering gear shall be considered as part of the boat weight. Determine the boat weight in accordance with the following paragraphs, and record on Line 6 of Data Sheet No. 2. If the test boat is delivered to the test laboratory with machinery installed, the motor, portable fuel tank(s), battery(s), control gear, etc., shall be removed prior to weighing the boat.
- b. Suspend an inline dynamometer or a load cell with a full scale range of not more than four times the weight of the boat from a crane hook and weigh and record the weight of all lifting apparatus such as strong-back cables, straps, shackles, etc. Record on Line 5 of Data Sheet No. 2.
- c. Attach boat to lifting apparatus, weigh and record total weight of lifting apparatus plus the boat. Record on Line 4 of Data Sheet No. 2.
- d. Subtract the weight of the lifting apparatus from the total weight and record the gross weight of the boat (H) on line 6 of Data Sheet No. 2.

4.4.2.3

Maximum Test Weight - Read the manufacturer's Maximum Weight Capacity (W_m) from the boat and record on Line 7 of Data Sheet No. 2. Calculate the Maximum Test Weights (MTW) in pounds using the following equations:

$$\begin{aligned} \text{MTW} &= 5.0 \times W_m \\ &= 5.0 \times \text{Line 7} \end{aligned}$$

Record the MTW on Line 8, and record 110% of the MTW on Line 9 of Data Sheet No. 2.

4.4.2.4

Displacement Test

- a. Place the boat into the water by means of an overhead crane using nylon straps or equivalent around the hull to protect it from damage. To support the boat in case of inadvertent swamping, the straps may be attached to

suitable points of the sides of the tank and left hanging loosely under the boat. Take care that the straps do not support the boat during the test. Place all machinery or suitable dummy weights in their operating position.

- b. Carefully load the boat with lead bricks or other suitable weights (steel blocks or concrete blocks) placed on the floorboards until the MTW, as recorded on Line 8 of Data Sheet No. 2, is reached, or until the maximum displacement as defined in Paragraph 4.4.1.1 is reached.
- c. Place all weights as low in the boat as possible. If it is necessary to place weights on top of deck-over areas, use a fixture to transfer weight to the gunwale as shown in Figure 5. Record on Line 12 of Data Sheet No. 1 possible areas subject to damage by loading. Remove lights, chocks, flag staffs and other appurtenances which interfere with the proper placement of the fixture, (add weights to compensate for such removal).
- d. The amount of weight required to load the boat to MTW may be computed as five times the "Maximum Weight Capacity (persons, motor and gear)" taken from the manufacturer's capacity label. It is recommended that the weights be weighed to within $\pm 1\%$ and be labeled with that weight.

* NOTE: Proper care of the weights is essential. Steel blocks must be kept free of rust, and lead blocks be kept from abuse by dropping, or scraping. Periodic re-checking of the weights is recommended.
- e. As the weights are placed in the boat, each block's weight shall be recorded and a running total kept. When the boat has been loaded with weights until the waterline is 1 to $1\frac{1}{2}$ inches from the major point of water ingress and the MTW has not yet been reached, carefully add weights in decreasing increments (5#, 2#, 1#) distributing the weights so that the boat sinks with points "S" and "T" equal distance above or below the water surface.

CAUTION: Apply the last 10% of the weight slowly and evenly to avoid exceeding the MTW.

- f. If the most forward point of the boat is still above the water surface and it appears that a greater displacement might be reached by moving some weight forward, adjust the weights forward and continue adding weights in such a way that point "S" is lower than point "T", but the forwardmost point does not go below the water surface.
- g. The crane hook shall be left connected to a large weight near the center of the boat so that a substantial amount of weight may be removed quickly in case of inadvertent swamping. Care should be taken to maintain the crane cable slack so that it does not support or add to the weight during the test.
- h. Just before the boat starts to ship water, or when the MTW is reached, immediately stop adding weights, and pump out any water that enters the boat. Indicate on Line 39 of Data Sheet 2, where the point of major water ingress occurs.
- i. Proceed in accordance with (1) or (2) below, whichever is applicable.
 - 1) If the boat ships water before MTW is reached, proceed to Step j below.
 - 2) If MTW is reached prior to the boat shipping water, add additional weight until the boat ships water or until 110% of MTW is reached, whichever occurs first. Proceed in accordance with (2a) or (2b) below, whichever is applicable.
 - a) If the boat ships water before reaching 110% of MTW, proceed to Step j below.
 - b) If the boat still does not ship water when 110% of MTW is reached, measure the remaining freeboard and record on Line 7 of Data Sheet No. 2. Proceed to Step j below.
- j. After all the weights have been placed in the boat, record the Total Test Weight, W_T , in pounds, on Line 11 of Data Sheet No. 2.

NOTE: To maintain ease in the handling and recording of the weights as they are placed in the boat, they should be divided into equal stacks. Each stack, for example, could contain 500 pounds. Other stacks, 100 pounds, for the final 10% of the MTW. This stack should have small increments of weight (i.e. 1, 2, and 5 lb blocks.) This would help double check the total weight placed in

the boat. The testing facility would keep a running total of weight, and when the maximum weight is placed in the boat, a quick check of the stack would give an accurate verification of the weight used. When the weights are removed from the boat, another running total must be kept. This is then compared to W_T recorded on Line 11 of Data Sheet No. 2. If the difference between the two is greater than 2.0%, the test must be repeated with greater care given to the recording of the weights as they are placed in the boat.

k. After the test is complete, measure the amount of water in the boat that was not removed by the bilge pump. If this amount of water is greater than one gallon, the test must be repeated. Perform whatever operations are necessary to ensure that the bilge pump, or any supplementary pumps, can continuously maintain a dry boat (with at most one gallon of water in the boat) at all times during the displacement test. Repeat the displacement test, recording all data on Data Sheet No. 2 as First Test data. After a successful displacement test has been performed, proceed to Paragraph 4.4.2.5.

NOTE: If it is necessary to use supplemental pumps to maintain a "dry" boat during this test, the weight of the pump and accessories should be recorded as part of the Total Test Weight used (Line 11 of Data Sheet No. 2.)

4.4.2.5 Displacement, D - Using the Total Test Weight, W_T , which is recorded on Line 11 of Data Sheet No. 2, calculate the displacement, D, using the following formula:

$$D = W_T + H$$

$$D = \text{Line 11} + \text{Line 6}$$

4.4.2.6 Maximum Weight Capacity, W_D - Using the test weight, W_T , which is recorded on Line 11 of Data Sheet No. 2, calculate the Maximum Weight Capacity, W_D , by using the formula:

$$\begin{aligned}
 W_D &= 0.20 [D - H] \\
 W_D &= .20 [(W_T + H) - H] \\
 &= .20 [(Line 11 + Line 6) - Line 6] \\
 &= .20 [Line 11]
 \end{aligned}$$

Record W_D on Line 13 of Data Sheet No. 2. Note that if the boat did not ship water at or before 110% of MTW, the W_D

is a fictitious Maximum Weight Capacity which is less than the actual Maximum Weight Capacity. However, subsequent use of W_D leads to the correct and desired result.

4.4.2.7 Maximum Weight Capacity, W - On Line 14 of Data Sheet No. 2, record the smaller of the following two values: W_m (Line 7) or W_D (Line 13). This value on Line 14 is the Maximum Weight Capacity, W .

4.4.2.8 Pass/Retest/Fail Criteria - Line 14 of Data Sheet No. 2 shows that the displacement test can result in a pass condition, a retest condition, or a fail condition. Criteria for these three conditions are given below.

a. % Deviation - The % Deviation between W_m (Line 7) and W_D (Line 13) is given by the formula:

$$\begin{aligned}
 \% \text{ Deviation} &= 100 (W_D - W_m) / W_D \\
 &= 100 \times (\text{Line 13} - \text{Line 7}) / \text{Line 13}
 \end{aligned}$$

Calculate the % Deviation, and record this value on Line 15 of Data Sheet No. 2.

b. Pass - If Line 15 is positive (W_D is greater than W_m), and if Line 15 is greater than two percent (2.0%), the boat passes the displacement test. Check 'Pass' on Line 16 of Data Sheet No. 2.

- c. Retest - If Line 15 lies between $\pm 2.0\%$ or is equal to either $\pm 2.0\%$, then a displacement retest is necessary since the test results lie within $\pm 2.0\%$ of the W_m . Check 'Retest' on Line 16 of Data Sheet No. 2
- d. Fail - If Line 15 is more negative than -2.0% (W_D is less than 98% of W_m), the boat fails the displacement test since the boat ships water before the manufacturer's Maximum Weight Capacity load is reached. Check 'Fail' on Line 16 of Data Sheet No. 2.

4.4.2.9

Repeat of Maximum Weight Capacity Test - Procedures set forth below are required only if Line 16 of Data Sheet No. 2 indicates that a repeat test is required; otherwise proceed to Paragraph 4.4.2.10. Repeat all test operations described in Paragraph 4.4.2.2 through Paragraph 4.4.2.7, and record all RETEST data in the right-hand RETEST boxes on the appropriate Line 4 through Line 15 of Data Sheet No. 2.

Calculate the % Deviation as described in Paragraph 4.4.2.8, and record this value on Line 15 of Data Sheet No. 2. Ignore the Pass/Retest/Fail criteria of Paragraph 4.4.2.8; and instead, use the following Pass/Fail criteria for the retest results:

- a. If Line 15 of Data Sheet No. 2 is greater than or equal to zero (0), check 'Pass' on Line 17 of Data Sheet No. 2.
- b. If Line 15 of Data Sheet No. 2 is negative, check 'Fail' on Line 17 of Data Sheet No. 2.
- c. If Line 15 lies between $\pm 1.0\%$, or is equal to $\pm 1.0\%$, check the third box of Line 17 of Data Sheet No. 2. This check indicates that the test boat passed or failed the test within the region of instrumentation error; that is, the difference between the manufacturer's Maximum Weight Capacity, W_m , and the calculated Maximum Weight Capacity, W , is within the 1.0% error of the instrumentation used in the test.

If the First Test and Retest values on Line 15 differ by more than 1.0%, explain the reason for this difference by explaining the principal differences between the First Test data and the Repeat Test data. Contact the USCG and explain the differences in the original test and the retest; and request permission to proceed with the test.

Proceed to Paragraph 4.4.2.10, regardless of whether or not the boat passed or failed the retest.

4.4.2.10 Maximum Persons Capacity, P_1 , by the W-Method - Using Line 14 of Data Sheet No. 2, let:

$$P_1 = W + \text{Line 14 of Data Sheet No. 2.}$$

Record the value of P_1 on Line 18 of Data Sheet No. 2.

4.4.2.11 Stability Warning Label (For boats assembled or under construction before 1 August 1973) - If a boat is marked as described by this paragraph, the Maximum Persons Capacity by the live load test method, as described in Paragraphs 4.4.2.12 through 4.4.2.16, may be omitted, provided the Maximum Persons Capacity displayed does not exceed the Maximum Weight Capacity (W). Inspect the boat for the following warning labels properly applied and record the applicable condition on Line 19 of Data Sheet No. 2. If the labels are present in accordance with the following, skip directly to Paragraph 4.4.2.17.

- a. The boat shall contain at least two waterproof labels permanently affixed in conspicuous positions readable from any normal boarding position.
- b. Each label shall consist of a plan view of the boat and the words in block letters in the sizes shown in Figure 1, in colors that contrast with the background of the label.

4.4.2.12 Machinery Weight

- a. Determine the machinery weight in accordance with the following paragraph and record on Line 20 of Data Sheet No. 2.

b. The machinery weight for boats rated for greater than 2 horsepower shall be as shown in the following table.

BOAT HORSEPOWER RATING

	MOTOR AND CONTROL WEIGHT	BATTERY WEIGHT	FULL PORTABLE FUEL TANK WEIGHT
	DRY	DRY	
0.1 to 2-----	25-----		
2.1 to 3.9-----	35-----		
4.0 to 7-----	55-----		25
7.1 to 15-----	75	20	50
15.1 to 25-----	100	45	50
25.1 to 45-----	155	45	100
45.1 to 80-----	240	45	100
80.1 to 150-----	315	45	100
150.1 to 250-----	420	45	100

TRANSOMS DESIGNED FOR TWIN
MOTORS

50.1 to 90-----	310	90	100
90.1 to 160-----	480	90	100
160.1 to 300-----	630	90	100

4.4.2.13 Maximum Test Live Load - Read and record on Line 21 of Data Sheet No. 2 the Maximum Persons Capacity (P_m) from the manufacturer's capacity markings. Calculate the Maximum Test Live Load (MTL) and record on Line 22 of Data Sheet No. 2. The MTL shall be calculated using the following equation:

$$\begin{aligned} \text{MTL} &= 0.60 P_m \\ &= 0.60 \times \text{Line 21} \end{aligned}$$

4.4.2.14

Live Load Capacity Test - The Live Load Capacity (LLC) shall be determined in accordance with the following paragraphs.

- a. Secure all equipment which may be subject to shifting as boat lists. Secure batteries and portable fuel tanks in particular. Insure that permanently installed fuel tanks are full.
- b. Insure that the interior of the boat is free of water. Using waterproof tape, cover all seams and other minor points of water ingress that will be submerged before the boat ships water.
- c. Place the boat into a water filled test tank by means of an overhead crane attached to a strong-back fixture and two nylon straps around the hull to protect it from damage. The straps may be attached to suitable points on the sides of the test tank and left hanging loosely under the boat as a precaution against sinking.
- d. Measure and record on Line 23 of Data Sheet No. 2 the specific gravity of the water in the test tank.
- e. Insure that all machinery or substitute dummy machinery is in the proper operating position. The center of gravity of a dummy motor, 50 horsepower or less, shall be placed at 3 inches \pm 1 inch above the top of the transom and 3 inches \pm 1 inch aft of the top aft edge of the transom. The center of gravity for dummy motors greater than 50 horsepower shall be placed at 1 inch \pm 1 inch below the top of the transom and 6 inches \pm 1 inch aft of the top edge of the transom. If no "normal positions" are provided for batteries or portable fuel tanks, these accessories shall be placed on the floorboards on the centerline of the boat as near to the transom as practicable. If some obstruction prevents placing the battery and/or fuel tank on the centerline, place them as near as practicable to the centerline but on the side of the applied load. Their position will be noted on Line 24 of Data Sheet No. 2.
- f. Tether the boat loosely at a minimum of three points to prevent contact of the boat with the sides of the tank.
★ CAUTION: Constantly observe these lines throughout the loading procedure to make sure they do not in any way support the weight of the boat and its load. Adjust as necessary.

g. Locate the seat nearest the geometric center of the passenger compartment. Determine the height from the floorboards (or their equivalent) to the top center of the seat, which shall be treated as an uncompressed seat if the seat is padded; that is, measure to the top center of the uncompressed seat. If there is only one passenger compartment, record this seat height on Line 25 of Data Sheet No. 2 and ignore the subsequent Lines 26 through 31.

If there are two passenger compartments (such as in bowriders), the above procedure shall be used for each passenger compartment, treating these compartments separately. In this case, the two seat heights shall be recorded on Lines 25 and 26 of Data Sheet No. 2. In this case also, determine the centerline lengths of the two passenger compartments. Record on Line 27 the centerline length L of the longer compartment, and record on Line 28 the centerline length L_s of the shorter compartment. Compute the centerline length ratio (L_s / L), and record this ratio on Line 29 of Data Sheet No. 2.

Referring to Line 30, the proportional amount of the test weight placed in the longer passenger compartment is determined from:

$$T = \frac{1}{1 + (L_s / L)} \times MTL$$

$$= \frac{1}{T + (\text{Line 29})} \times (\text{Line 22}).$$

Referring to Line 31, the proportional amount of the test weight placed in the shorter passenger compartment is determined from:

$$T_s = (L_s / L) \times T$$

$$= (\text{Line 29}) \times (\text{Line 30a or 30b})$$

h. Determine the (port or starboard) side of the boat which is most likely to ship water first under a load placed along that side of the boat. Factors such as non-symmetrical geometry, holes for control cables, and a

permanent list shall be considered in selecting the side of the boat to be tested. If opposing conditions make it difficult to determine the "worst side", then both sides of the boat shall be tested. For a symmetrical boat, either side may be tested.

1. Lead weights shall be placed into the test boat so that the following requirements are met:

- 1) Weights shall be placed along the side of the boat which is most likely to ship water first as determined by Step h above. If both sides are to be tested, first test the port side then test the starboard side, as separate and independent tests.
 - 2) In each passenger compartment, and at each station where weights are placed, the total weight at that station shall have a combined center of gravity which is:
 - * 1.5 in. inboard of the outboard extremity of the passenger compartment at that station;
 - * Located at the appropriate seat height indicated on Line 25 or 26 of Data Sheet No. 2.
 - 3) As a minimum requirement, at least three equal weights shall be placed in each passenger compartment. One of these three weights shall be located midway between the ends of the passenger compartment. The second (third) weight shall be located so that its distance from one end (the other end) of the passenger compartment is equal to one-sixth of the centerline length of the passenger compartment.
 - * NOTE: If the centerline length of the passenger compartment is divided into three segments, each having a length equal to one-third of the centerline length, then each of the above three weights is located at the center of one of the three centerline segments.

4) Additional weights shall be added by placing six equal weights in the boat, with two weights placed on the two sides and adjacent to each of the three initial weights. The size of the six weights shall be selected so that the boat does not ship water during placement of the six weights. Additional weights shall be placed in the boat in a similar manner - six equal weights for each loading increment.

5) If there are two passenger compartments, the methods described in Steps (3) and (4) above shall be used for loading both compartments. Each additional loading increment shall include simultaneous loading of both compartments. After each loading increment is applied, the total load in the shorter compartment divided by the total load in the longer compartment shall be equal to the centerline length ratio shown on Line 29 of Data Sheet No. 2.

6) If the top center of the uncompressed seat is above the height of the gunwale (as in some bass boats), the center of gravity of the weights shall be placed at the height of the gunwale amidships.

7) The final loading increment shall not exceed 10 pounds unless 110% of MTL is reached before shipping water.

8) The adding of weight increments shall continue until one of the following two conditions is satisfied, whichever occurs first:

- * The boat ships water when the weights described in Steps (3) through (7) are added; or
- * The total load in the boat is equal to 110% of the MTL ($110\% \times$ Line 22 of Data Sheet No. 2).
- * NOTE: The Total Weight Load, A, evolves from the Maximum Test Live Load, MTL. The Total Weight Load, A, can be higher (up to 110%) or lower (if the boat sinks before $A = MTL$) than MTL. In either case, A is

determined by the incremental loading procedures described above. Therefore, the proportional loading ratio required for boats with two passenger compartments although determined from the MTL, is valid for loads greater than or less than MTL.

j. On Data Sheet No. 2, record the weight in the boat in the appropriate manner listed below:

- 1) If the boat has a single passenger compartment, record the Total Weight Load, A, on Line 32a for Port Side Loading or on Line 32b for Starboard Side Loading. In either case, neglect the formulas listed on Line 32.
- 2) If the boat has two passenger compartments, record the Total Weight Load, T, in the longer passenger compartment on Line 30a (b) for Port (Starboard) Side Loading. Record the Total Weight Load, T_s , in the shorter passenger compartment on Line 31a (b) for Port (Starboard) Side Loading. Add Line 30a (b) and Line 31a (b), and record the sum on Line 32a (b) for Port (Starboard) Side Loading.
- 3) If the weight load in the boat is 110% of MTL, measure the remaining freeboard and record on Line 33 of Data Sheet No. 2.

k. If both sides of the boat must be tested, as determined in Step h above, then perform the test on the second side following all of the steps indicated in Steps i through j.

4.4.2.15 Maximum Persons Capacity, P_2 , by the Live Load Capacity
Method - Calculate the Maximum Persons Capacity, P_2 , by
use of the following formula:

$$\begin{aligned}
 P_2 &= (\text{Total Test Weight, A}) / 0.60 \\
 &= 1.67 \times \text{Line 32a or Line 33 for Port} \\
 &\quad \text{Side Loading} \\
 &= 1.67 \times \text{32(b) or Line 33(b) for Starboard} \\
 &\quad \text{Side Loading}
 \end{aligned}$$

Record the value of P_2 on Line 34a (b) for Port (Starboard) Side Loading. Also record this value of P_2 on Line 34(a) if only one side of the boat was tested; however, if both sides were tested, record on Line 34(c), the smaller of the two values of P_2 (Port) and P_2 (Starboard).

4.4.2.16 Maximum Allowable Persons Capacity, P - Enter on Line 35 of Data Sheet No. 2 the value of P which is defined as the lesser of the two values: P_1 (Line 18) and P_2 (Line 34c).

4.4.2.17 Pass/Retest/Fail Criteria - Conditions for pass, retest or fail of the Live Load Capacity Test are given below. Proceed with Step a below, followed by the appropriate Steps b through f.

* NOTE: If 110% of MTL was reached with freeboard remaining, ignore Line 36 and check "Pass" in the first block on Line 37 of Data Sheet No. 2. Also, check pass on Line 37 if boat displays proper stability label and meets conditions of 4.4.1.3.

a. % Deviation - The % Deviation between P_m (Line 21) and P (Line 35) is given by the formula:

$$\begin{aligned}
 \% \text{ Deviation} &= 100 (P - P_m) / P \\
 &= 100 \times (\text{Line 35} - \text{Line 21}) / \text{Line 35}
 \end{aligned}$$

Calculate the % Deviation, and record this value on Line 35 of Data Sheet No. 2.

- b. Pass - If the % Deviation (Line 36) is positive (P is greater than P_m), and if Line 36 is greater than one percent (1.0%), the boat passes the Live Load Capacity test. Check 'Pass' in the first box on Line 37 of Data Sheet No. 2.
- c. Pass - If P_m (Line 21) is less than or equal to P_1 (Line 19), and if the boat meets all of the requirements of Paragraph 4.4.2.11, the boat passes the Live Load Capacity test. Check "Pass" in the second box on Line 37 of Data Sheet No. 2.
- d. Retest - If the % Deviation (Line 36) lies between $\pm 1.0\%$, or is equal to either $\pm 1.0\%$, the Live Load Capacity test must be repeated. Check 'Retest' in the third box on Line 37 of Data Sheet No. 2.
- e. Fail - If the % Deviation (Line 36) is more negative than -1.0% , the boat fails the Live Load Capacity test. Check 'Fail' in the fourth box on Line 37 of Data Sheet No. 2.
- f. Fail - If P_m (Line 21) is greater than P_2 (Line 34c), and if P_m (Line 21) is less than P_1 (Line 18), and if Line 19 indicates that the boat either does not display stability warning labels, or does display stability warning labels that do not meet all of the requirements of Paragraph 4.4.2.11, the boat fails the Live Load Capacity test. Check 'Fail' in the fifth box on Line 37 of Data Sheet No. 2.

If the boat must be retested proceed to Paragraph 4.4.2.18; otherwise proceed to Paragraph 4.4.2.19.

4.4.2.18 Live Load Capacity Repeat Test

- a. Repeat all test operations from Paragraphs 4.4.2.14 through 4.4.2.17a. Record all retest data in the right-hand set of blocks provided for this purpose on Data Sheet No. 2.
- b. If the % Deviation (Line 36) for the retest is greater than or equal to zero (0), check 'Pass' on Line 38 of Data Sheet No. 2.
- c. If the % Deviation (Line 36) for the retest is negative, check 'Fail' on Line 38 of Data Sheet No. 2.
- d. If the % Deviation (Line 36) for the retest lies between $\pm 1.0\%$, or is equal to either $\pm 1.0\%$, check the third box on Line 38 of Data Sheet No. 2 since the retest pass or fail condition lies within measurement error.

If the First Test and Retest values differ by more than 1.0%, explain the reason for this difference by explaining the principal differences between the First Test data and the Retest data. Contact the USCG and explain the differences in the original test and the retest.

4.4.2.19 Equipment

See Paragraph 4.7.

4.5 Safe Loading Tests -- Inboard and Inboard/Outboard Boats

4.5.1 Requirements

4.5.1.1 Maximum Weight Capacity (W) - The Maximum Weight Capacity, W_m , marked on inboard and inboard/outboard boats must not exceed the greater value of W as determined by either the formula:

$$W = 0.20 [\text{Max Displacement, } D - \text{Boat Weight, } H] - 0.80 [\text{Machinery Weight, } M]$$

$$W = 0.20 [\text{Test Weight, } W_T + \text{Boat Weight, } H - \text{Boat Weight, } H] - 0.80 [\text{Machinery Weight, } M]$$

$$W = 0.20 [\text{Test Weight, } W_T] - 0.80 [\text{Machinery Weight, } M]$$

or the formula:

$$W = 0.143 [\text{Maximum Displacement, } D - \text{Boat Weight, } H]$$

$$W = 0.143 [\text{Test Weight, } W_T + \text{Boat Weight, } H - \text{Boat Weight, } H]$$

$$W = 0.143 [\text{Test Weight, } W_T]$$

where: "Boat Weight" means the combined weight in pounds of the deck, superstructure and boat hull and all its original and permanent appurtenances, including Machinery Weight, and Full Fuel system and tank(s), and

"Machinery Weight" means the total weight of installed engine(s) or motor(s), control equipment, drive unit, and battery(s), and

"Maximum Displacement" means the weight of the volume of water, measured in pounds, displaced by the boat at its maximum level immersion in calm water without major ingress of water. For this purpose a boat is considered level when it is transversely level and when either of the two following conditions are met:

- (i) The forward point where the sheer intersects the vertical centerline plane and the aft point where the sheer intersects the upper boundary of the transom (stern) are equidistant above the water surface or are equidistant below the water surface.
- (ii) The most forward point of the boat is level with or above the lowest point of water ingress.

4.5.1.2 Maximum Persons Capacity (P) - Except as provided for in Paragraph 4.5.1.3 below, the value marked on inboard, and inboard-outboard boats must be expressed in pounds and must not be greater than the lesser of P_1 or P_2 as determined below.

P_1 = Maximum Weight Capacity (W) where:

W = "Maximum Weight Capacity" as defined in Paragraph 4.5.1.1

P_2 = Live Load Capacity (LLC) where:

"Live Load Capacity" is determined from the following test:

1. Float the boat, with all its original and permanent appurtenances, including installed engine(s), full fuel system and tank(s), control equipment, drive unit, and batteries, in calm water.
2. Gradually add additional off-center weights equally distributed along one outboard extremity of the passenger carrying area at the height of the seat nearest to the center of that area and in a plane parallel to the floor boards, until the boat assumes a list or trim, or both, just short of allowing water to come aboard. If the boat has more than one passenger carrying area, distribute the weights in proportion to the centerline length of the passenger areas. If the seats are above the gunwale, the center of gravity of the weights shall be placed at the height of the gunwale amidships.

The Live Load Capacity is A/0.6, where A is the total of the off-center weights added above.

4.5.1.3 Maximum Persons Capacity Exceptions (For Boats Assembled or Under Construction Before 1 August 1973).

- a. At least two waterproof labels permanently affixed so as to be conspicuous and readable from any normal boarding position.

- b. Each label consisting of a plan view of the boat and the words in block letters in the sizes shown in Figure 1, in colors that contrast with the background of the label.

4.5.1.4 Persons Capacity in Whole Numbers of Persons
See Section 183.39 in Subpart C at the end of this test procedure.

4.5.2 Methods

4.5.2.1 Dimensional Measurement

- a. Place the boat on a boat trailer or chocks on a flat floor and trim the boat until the lowest point on the boat which is 40% of the boat's length aft of the forward most point on the boat is level with the lowest point on the boat which is 75% of the boat's length aft of the forward most point on the boat. (Refer to Figure 2.)
 - * NOTE: Concrete floors are normally flat to within 1/4 inch. Flatness may be verified by use of a surveyor's level and rod placed on a two-foot grid pattern.
- b. Level the boat transversely by trimming it from side to side until corresponding points at either side of the transom are equal distance from the floor.
- c. Drop a plumb bob to the floor from the most forward part of the boat on centerline. Similarly, drop a plumb bob at the aftermost part of the boat on centerline. Using a tape, measure the boat length (L) between the plumb bobs at the floor and record this value on Line 2 of Data Sheet No. 3.

- * NOTE: If either the most forward point or aftermost point of the boat does not fall on centerline, use a string or straight edge to span the gap so that "L" represents the true maximum length as seen in profile.
- d. Check that length (L) is less than twenty (20) feet. If "L" equals or is greater than twenty (20) feet, terminate testing to the Safe Loading standard.
- e. Locate the point where the sheer intersects the vertical centerline plane of the boat at the forward end. Place the 45° indicating instrument in a vertical longitudinal plane on the boat's centerline and bring it into contact with the boat at the bow. Mark this point "S" (see Figure 2).

* NOTE: If the sheer intersects the vertical centerline plane of the boat at more than one point, the highest point of intersection will be marked as Point "S".

- f. Place the 45° indicating instrument in a series of vertical longitudinal planes across the boat's transom (stern) bringing the instrument into contact with the boat's transom (stern). Mark these points along the upper boundary of the transom (stern).

Mark Point(s) "T" at the intersection(s) of the sheer with the upper boundary of the transom.

- * NOTE: If the sheer intersects the upper boundary of either side of the transom at more than one point, the highest point of intersection will be marked as "T".
- g. Seal minor leaks with waterproof tape or other suitable sealing media. Minor leaks include the hull/deck junction, handles, rivet holes, lifting eyes, etc. Vent holes shall not be sealed. Where controls pass through the hull or deck and a sealing boot is provided, minor leaks in the boot(s) shall be sealed. For outboard boats, one such motor well opening may be sealed when no boot is installed, provided its greatest dimension is not over three (3) inches and its purpose is for motor controls or fuel lines. Record any difficulties encountered in sealing the boat on Line 39 of Data Sheet No. 3.

* NOTE: Boats which are designed to be self-bailing shall have the self-bailing scuppers sealed prior to testing, regardless of the size of the openings.

4.5.2.2 Boat Weight

- a. Boat Weight (H) is the combined weight, in pounds, of the deck, superstructure, and boat hull and all its original and permanent appurtenances, including Machinery Weight and Full Fuel system and tanks. Determine the boat weight in accordance with the following paragraphs and record on Line 6 of Data Sheet No. 3
- b. Suspend an inline dynamometer or a load cell with a full-scale range of not more than four times the weight of the boat from a crane hook and weigh and record the weight of all lifting apparatus such as strongback cables, straps, shackles, etc. Record on Line 5 of Data Sheet No. 3.
- c. Attach boat to lifting apparatus and weigh and record lifting apparatus plus the boat. Record on Line 4 of Data Sheet No. 3.
- d. Subtract the weight of the lifting apparatus as determined in Paragraph 4.5.2.2b from the total weight as determined in Paragraph 4.5.2.2c and record the gross weight of the boat (H) on Line 6 of Data Sheet No. 3.

4.5.2.3 Machinery Weight

- a. Machinery Weight includes the weight of the engine(s), or motor, control equipment, drive unit, and battery(s). Determine the machinery weight in accordance with the following paragraphs and record on Line 7 of Data Sheet No. 3.

b. Determine the machinery weight of the boat from data furnished by the machinery manufacturer. If the weights of the equipment are not available from manufacturer, the following weights shall be used:

Battery (each)	45 Lb
Control Equipment (each engine)	15 Lb

4.5.2.4 Maximum Test Weight Read the manufacturer's Maximum Weight Capacity (W_m) from the boat and record on Line 8 of Data Sheet

No. 3. Calculate the Maximum Test Weight (MTW) in pounds using the following equations:

$$\begin{aligned} \text{MTW} &= 5 W_m + 4M \\ &= 5.0 \times \text{Line 8} + 4.0 \times \text{Line 7} \\ \text{MTW} &= 7.0 W_m \\ &= 7.0 \times \text{Line 8} \end{aligned}$$

Record both MTW's in the appropriate place on Line 9, and record 110% of the lesser MTW value on Line 10 of Data Sheet No. 3.

4.5.2.5 Displacement Test

a. Place the boat into the water by means of an overhead crane using nylon straps or equivalent around the hull to protect it from damage. To support the boat in case of inadvertent swamping, the straps may be attached to suitable points of the sides of the tank and left hanging loosely under the boat. Take care that the straps do not support the boat during the test. Place all machinery or suitable dummy weights in their operating position.

- b. Carefully load the boat with lead bricks or other suitable weights (steel blocks or concrete blocks) placed on the floorboards until the MTW, as recorded on Line 9 of Data Sheet No. 3, is reached, or until the maximum displacement as defined in Paragraph 4.4.1.1 is reached.
- c. Place all weights as low in the boat as possible. If it is necessary to place weights on top of deck-over areas, use a fixture to transfer weight to the gunwale as shown in Figure 5. Record on Line 12 of Data Sheet No. 1 possible areas subject to damage by loading. Remove lights, chocks, flag staffs and other appurtenances which interfere with the proper placement of the fixture, (add weights to compensate for such removal).
- d. The amount of weight required to load the boat to MTW may be computed as five times the "Maximum Weight Capacity (persons, motor and gear)" taken from the manufacturer's capacity label. It is recommended that the weights be weighed to within $\pm 1\%$ and be labeled with that weight.

* NOTE: Proper care of the weights is essential. Steel blocks must be kept free of rust, and lead blocks be kept from abuse by dropping, or scraping. Periodic re-checking of the weights is recommended.
- e. As the weights are placed in the boat, each block's weight shall be recorded and a running total kept. When the boat has been loaded with weights until the waterline is 1 to $1\frac{1}{2}$ inches from the major point of water ingress and the MTW has not yet been reached, carefully add weights in decreasing increments (5#, 2#, 1#) distributing the weights so that the boat sinks with points "S" and "T" equal distance above or below the water surface.

CAUTION: Apply the last 10% of the weight slowly and evenly to avoid exceeding the MTW.

- f. If the most forward point of the boat is still above the water surface and it appears that a greater displacement might be reached by moving some weight forward, adjust the weights forward and continue adding weights in such a way that point "S" is lower than point "T", but the forwardmost point does not go below the water surface.
- g. The crane hook shall be left connected to a large weight near the center of the boat so that a substantial amount of weight may be removed quickly in case of inadvertent swamping. Care should be taken to maintain the crane cable slack so that it does not support or add to the weight during the test.
- h. Just before the boat starts to ship water, or when the MTW is reached, immediately stop adding weights, and pump out any water that enters the boat. Indicate on Line 39 of Data Sheet 3, where the point of major water ingress occurs.
- i. Proceed in accordance with (1) or (2) below, whichever is applicable.
 - 1) If the boat ships water before MTW is reached, proceed to Step j below.
 - 2) If MTW is reached prior to the boat shipping water, add additional weight until the boat ships water or until 110% of MTW is reached, whichever occurs first. Proceed in accordance with (2a) or (2b) below, whichever is applicable.
 - a) If the boat ships water before reaching 110% of MTW, proceed to Step j below.
 - b) If the boat still does not ship water when 110% of MTW is reached, measure the remaining freeboard and record on Line 11 of Data Sheet No. 3. Proceed to Step j below.
- j. After all the weights have been placed in the boat, record the Total Test Weight, W_T , in pounds, on Line 12 of Data Sheet No. 3.

NOTE: To maintain ease in the handling and recording of the weights as they are placed in the boat, they should be divided into equal stacks. Each stack, for example, could contain 500 pounds. Other stacks, 100 pounds, for the final 10% of the MTW. This stack should have small increments of weight (i.e. 1, 2, and 5 lb blocks.) This would help double check the total weight placed in the boat. The testing facility would keep a running total of weight, and when the maximum weight is placed in the boat, a quick check of the stack would give an accurate verification of the weight used. When the weights are removed from the boat, another running total must be kept. This is then compared to W_T recorded on Line 12 of Data Sheet No. 3. If the difference between the two is greater than 2.0%, the test must be repeated with greater care given to the recording of the weights as they are placed in the boat.

k. After the test is complete, measure the amount of water in the boat that was not removed by the bilge pump. If this amount of water is greater than one gallon, the test must be repeated. Perform whatever operations are necessary to ensure that the bilge pump, or any supplementary pumps, can continuously maintain a dry boat (with at most one gallon of water in the boat) at all times during the displacement test. Repeat the displacement test, recording all data on Data Sheet No. 3 as First Test data. After a successful displacement test has been performed, proceed to Paragraph 4.5.2.6.

NOTE: If it is necessary to use supplemental pumps to maintain a "dry" boat during this test, the weight of the pump and accessories should be recorded as part of the Total Test Weight used (Line 12 of Data Sheet No. 3.)

4.5.2.6 Displacement, D - Using the Total Test Weight, W_T , which is recorded on Line 12 of Data Sheet No. 3, calculate the displacement, D, using the following formula:

$$D = W_T + H$$

$$D = \text{Line 11} + \text{Line 6}$$

4.5.2.7 Maximum Weight Capacity, W_D - Using the total test weight, W_T , which is recorded on Line 12 of Data Sheet No. 3, calculate the Maximum Weight Capacity, W_D , by using the formula:

$$\begin{aligned} W_D &= 0.20 [D - H] - 0.80 [M] \\ W_D &= 0.20 [(W_T + H) - H] - 0.80 M \\ &= 0.20 [(Line 12 + Line 6) - Line 6] \\ &\quad - 0.80 \times Line 7 \\ &= 0.20 [Line 12] - 0.80 [Line 7] \end{aligned}$$

or,

$$\begin{aligned} W_D &= 0.143 [D - H] \\ W_D &= 0.143 [(W_T + H) - H] \\ &= 0.143 [(Line 12 + Line 6) - Line 6] \\ &= 0.143 [Line 12] \end{aligned}$$

Record W_D on Line 14 of Data Sheet No. 3. Note that if the boat did not ship water at or before 110% of MTW, the W_D is a fictitious Maximum Weight Capacity.

4.5.2.8 Maximum Weight Capacity, W - On Line 15 of Data Sheet No. 3, record the smaller of the following two values: W_p (Line 8) or the greater W_D value determined in Line 14. This value on Line 15 is the Maximum Weight Capacity, W .

4.5.2.9 Pass/Retest/Fail Criteria - Line 15 of Data Sheet No. 3 shows that the displacement test can result in a pass condition, a retest condition, or a fail condition. Criteria for these three conditions are given below.

- a. % Deviation - The % Deviation between W_m and W_D is given by the formula:

$$\% \text{ Deviation} = 100 (W_D - W_m) / W_D$$

$$= 100 \times (\text{Line 14} - \text{Line 8}) / \text{Line 14}$$

Calculate the % Deviation, and record this value on Line 16 of Data Sheet No. 3.

- b. Pass - If Line 16 is positive (W_D is greater than W_m), and if Line 16 is greater than two percent (2.0%), the boat passes the displacement test. Check 'Pass' on Line 17 of Data Sheet No. 3.
- c. Retest - If Line 16 lies between $\pm 2.0\%$, or is equal to either $\pm 2.0\%$, then a displacement retest is necessary since the test results lie within $\pm 2.0\%$ of W_m . Check 'Retest' on Line 17 of Data Sheet No. 3.
- d. Fail - If Line 16 is more negative than -2.0% (W_D is less than 98% of W_m), the boat fails the displacement test since the boat ships water before the manufacturer's Maximum Weight Capacity load is reached. Check 'Fail' on Line 17 of Data Sheet No. 3.

4.5.2.10 Repeat of Maximum Weight Capacity Test - Procedures set forth below are required only if Line 17 of Data Sheet No. 3 indicates that a repeat is required; otherwise proceed to Paragraph 4.5.2.11. Repeat all test operations described in Paragraphs 4.5.2.2 through 4.5.2.6, and record all RETEST data in the right-hand RETEST boxes on the appropriate Line 4 through Line 16 of Data Sheet No. 3.

Calculate the % Deviation as described in Paragraph 4.5.2.9, and record this value on Line 16 of Data Sheet No. 3. Ignore the Pass/Retest/Fail criteria of Paragraph 4.5.2.9; and instead, use the following Pass/Fail criteria for the retest results:

- a. If Line 16 of Data Sheet No. 3 is greater than or equal to zero (0), check 'Pass' on Line 18 of Data Sheet No. 3.

- b. If Line 16 of Data Sheet No. 3 is negative, check 'Fail' on Line 18 of Data Sheet No. 3.
- c. If Line 16 lies between + 1.0%, or is equal to check the third box of Line 18 of Data Sheet No. 3. This check indicates that the test boat passed or failed the test within the region of instrumentation error; that is, the difference between the manufacturer's Maximum Weight Capacity, W_m , and the calculated Maximum Weight Capacity, W_D is within the 1.0% error of the instrumentation used in the test.

If the First Test and Retest values on Lines 16 differ by more than 1.0%, explain the reason for this difference by explaining the principal differences between the First Test data and the Repeat Test data. Contact the USCG and explain the differences in the original test and the retest and request permission to proceed with the test.

4.5.2.11 Maximum Persons Capacity, P_1 , by the W-Method - Using Line 15 of Data Sheet No. 3, let!

$$P_1 = W = \text{Line 15 of Data Sheet No. 3}$$

Record the value of P_1 on Line 19 of Data Sheet No. 3.

4.5.2.12 Stability Warning Label - If a boat is marked as described by this paragraph, the Maximum Persons Capacity by the live load test method, as described in Paragraphs 4.5.2.13 through 4.5.2.15, may be omitted provided the Maximum Persons Capacity displayed does not exceed the Maximum Weight Capacity (W). Inspect the boat for the following warning labels properly applied and record the applicable condition on Line 20 of Data Sheet No. 3. If the labels are present in accordance with the following, skip directly to Paragraph 4.5.2.16.

- a. The boat shall contain at least two waterproof labels permanently affixed in conspicuous positions readable from any normal boarding position.
- b. Each label shall consist of a plan view of the boat and the words in block letters in the sizes shown in Figure 1, in colors that contrast with the background of the label.

4.5.2.13 Maximum Test Live Load - Read and record on Line 21 of Data Sheet No. 3 the Maximum Persons Capacity (P_m) from the manufacturer's capacity markings. Calculate the Maximum Test Live Load (MTL) and record on Line 22 of Data Sheet No. 3. The MTL shall be calculated using the following equation:

$$MTL = 0.60 P_m$$

$$= 0.60 \times \text{LINE 21}$$

4.5.2.14 Live Load Capacity Test - The Live Load Capacity (LLC) shall be determined in accordance with the following paragraphs.

- a. Secure all equipment which may be subject to shifting as boat lists. Secure batteries and portable fuel tanks in particular. Insure that permanent fuel tanks are full.
- b. Insure that the interior of the boat is free of water. Examine gunwales, decked areas, etc., for structural integrity and reinforce as necessary prior to applying loads. Refer to Line 12 of Data Sheet No. 1. Using waterproof tape, cover all seams and other minor points of water ingress that will be submerged before the boat ships water.
- c. Place the boat into a water-filled test tank by means of an overhead crane attached to a strong-back fixture and two nylon straps around the hull to protect it from damage. The straps may be attached to suitable points on the sides of the test tank and left hanging loosely under the boat as a precaution against sinking.
- d. Measure and record on Line 23 of Data Sheet No. 3 the specific gravity of the water in the test tank.
- e. Insure that all machinery or substitute dummy machinery is in the proper operating position. If no "normal positions" are provided for batteries or portable fuel tanks, these accessories shall be placed on the floorboards on the centerline of the boat as near to the transom as practicable. If some obstruction prevents placing the battery and/or fuel tanks on the centerline, place them as near as practicable to the centerline but on the side of the applied load. Their position shall be noted on Line 24 of Data Sheet No. 3.
- f. Tether the boat loosely at a minimum of three points to prevent contact of the boat with the sides of the tank.

CAUTION: Constantly observe these lines throughout the loading procedure to make sure they do not in any way support the weight of the boat and its load. Adjust as necessary.

g. Locate the seat nearest the geometric center of the passenger compartment. Determine the height from the floorboards (or their equivalent) to the top center of the seat which shall be treated as an uncompressed seat if the seat is padded; that is, measure to the top center of the uncompressed seat. If there is only one passenger compartment, record this seat height on Line 25 of Data Sheet No. 3 and ignore the subsequent Lines 26 through 31.

If there are two passenger compartments (such as bowriders), the above procedure shall be used for each passenger compartment, treating these compartments separately. In this case, the two seat heights shall be recorded in Lines 25 and 26 of Data Sheet No. 3. In this case, also determine the centerline lengths of the two passenger compartments.

Record on Line 27, the centerline length L of the longer compartment, and record on Line 28, the centerline length of the shorter compartment. Compute the centerline length ratio (L_s/L), and record this ratio on Line 29 of Data Sheet No. 3.

Referring to Line 30 the proportional amount of the test weight placed in the longer passenger compartment is determined from:

$$T = \frac{1}{1 + (L_s / L)} \times MTL$$
$$= \frac{1 \times (\text{Line 22})}{1 + (\text{Line 29})}$$

Referring to Line 31, the proportional amount of the test weight placed in the shorter passenger compartment is determined from:

$$T = (L_s / L) \times T$$
$$= (\text{Line 29} \times (\text{Line 30a or b}))$$

h. Determine the (port or starboard) side of the boat which is most likely to ship water first under a load placed along that side of the boat. Factors such as non-symmetrical geometry, holes for control cables, and a permanent list shall be considered in selecting the side of the boat to be tested. If opposing conditions make it difficult to determine the "worst side", then both sides of the boat shall be tested. For a symmetrical boat, either side may be tested.

*i. Lead weights shall be placed into the test boat so that the following requirements are met:

- 1) Weights shall be placed along the side of the boat which is most likely to ship water first as determined by Step (h) above. If both sides are to be tested, first test say the port side, then test the starboard side, as separate and independent tests.
- 2) In each passenger compartment, and at each station where weights are placed, the total weight at that station shall have a combined center of gravity which is:
 - 1.5 in. inboard of the outboard extremity of the passenger compartment at that station;
 - Located at the appropriate seat height indicated on Line 25 or 26;
 - If the seats are above the gunwale, the center of gravity of the weights shall be placed at the height of the gunwale, amidships.
- 3) As a minimum requirement, at least three equal weights shall be placed in each passenger compartment. One of these three weights shall be located midw. between the ends of the passenger compartment. The second (third) weights shall be located so that its distance from one end (the other end) of the passenger compartment is equal to one-sixth of the centerline length of the passenger compartment.
 - * NOTE: If the centerline length of the passenger compartment is divided into three segments, each having a length equal to one-third of the centerline length, then each of the above three weights is located at the center of one of the three centerline segments.

- 4) Additional weights shall be added by placing six equal weights in the boat, with two weights placed on the two sides and adjacent to each of the three initial weights. The size of the six weights shall be selected so that the boat does not ship water during placement of the six weights. Additional weights shall be placed in the boat in a similar manner --- six equal weights for each loading increment.
- 5) If there are two passenger compartments, the methods described in Steps (3) and (4) above shall be used for loading both compartments. Each additional loading increment shall include simultaneous loading of both compartments. After each loading increment is applied, the total load in the shorter compartment divided by the total load in the longer compartment shall be equal to the centerline length ratio shown on Line 29 of Data Sheet No. 3.
- 6) If the top center of the uncompressed seat is above the height of the gunwale (as in some Bass Boats), the center of gravity of the weights shall be placed at the height of the gunwale, amidships.
- 7) The final loading increment shall not exceed 10 lbs. unless 110% of MTL is reached before shipping water.

- 8) The adding of incremental weights shall continue until one of the following two conditions is satisfied, whichever occurs first:

- The boat ships water when the weights described in Steps (1) through (6) above are added; or
- The total load in the boat is equal to 110% of MTL ($110\% \times$ Line 22 of Data Sheet No. 3).

* NOTE: The Total Weight Load, A, evolves from the Maximum Test Live Load, MTL. The Total Weight Load, A, can be higher (up to 110%) or lower (if the boat sinks before $A = MTL$) than MTL. In either case, A is determined by the incremental loading procedures described above. Therefore, the proportional loading ratio required for boats with two passenger compartments although determined from the MTL, is valid for loads greater than or less than MTL.

j. On Data Sheet No.3, record the weight in the boat in the appropriate manner listed below:

- 1) If the boat has a single passenger compartment, record the Total Weight Load, A, on Line 32(a) for Port Side Loading or on Line 32(b) for Starboard Side Loading. In either case, neglect the formulas listed on Lines 30 and 31.
- 2) If the boat has two passenger compartments, record the Total Weight Load, T, in the longer passenger compartment on Line 30a(b) for Port (Starboard) Side Loading. Record the Total Weight Load, T_s, in the shorter passenger compartment on Line 31a(b) for Port (Starboard) Side Loading. Add Line 30a(b) and Line 31a(b), and record the sum on Line 32a(b) for Port (Starboard) Side Loading.
- 3) If the weight load in the boat is 110% of MTL, measure the remaining freeboard and record on Line 33 of Data Sheet No. 3.

k. If both sides of the boat must be tested, as determined in Step (h) above, then perform the test on the second side following all of the steps indicated in Steps (i) and (j) above.

4.5.2.15 Maximum Persons Capacity, P₂, by the Live Load Capacity Method - Calculate the Maximum Persons Capacity, P₂, by use of the formula:

$$\begin{aligned}P_2 &= (\text{Total Test Weight, A})/0.60 \\&= 1.67 \times \text{Line 32a for Portside Loading} \\&= 1.67 \times \text{Line 32b for Starboard Side Loading}\end{aligned}$$

Record the value of P₂ on Line 34a(b) for Port (Starboard) Side Loading. Also, record this value of P₂ on Line 34c, if only one side of the boat was tested; however, if both sides were tested, record on Line 34c, the smaller of the two values P₂ (Port) and P₂ (Starboard).

4.5.2.16 Maximum Allowable Persons Capacity, P - Enter on Line 35 of Data Sheet No. 3, the value of P which is defined as the lesser of the two values: P₁ (Line 19) and P₂ (Line 34c).

4.5.2.17 Pass/Retest/Fail Criteria - Conditions for pass, retest or fail of the Live Load Capacity Test are given below. Proceed with Step (a) below, followed by the appropriate Steps (b) through (f).

* NOTE: If 110% of MTL was reached with freeboard remaining, ignore Line 36 and check 'Pass' in the first block on Line 37 of Data Sheet No. 3.

a. % Deviation - The % Deviation between P_m (Line 21) and P (Line 35) is given by the formula:

$$\begin{aligned}\% \text{ Deviation} &= 100 (P - P_m) / P \\ &= 100 \times (\text{Line 35} - \text{Line 21}) / \text{Line 35}\end{aligned}$$

Calculate the % Deviation, and record this value on Line 36 of Data Sheet No. 3.

b. Pass - If the % Deviation (Line 36) is positive (P is greater than P_m), and if Line 36 is greater than one-percent (1.0%), the boat passes the Live Load Capacity test. Check 'Pass' in the first box on Line 37 of Data Sheet No. 3.

c. Pass - If P_m (Line 21) is less than or equal to P_1 (Line 19), and if P_m (Line 21) is greater than P_2 (Line 34c), and if the boat meets all of the requirements of Paragraph 4.5.2.12, the boat passes the Live Load Capacity test. Check 'Pass' in the second box on Line 37 of Data Sheet No. 3.

d. Retest - If the % Deviation (Line 36) lies between $\pm 1.0\%$, or is equal to either $\pm 1.0\%$, the Live Load Capacity test must be repeated. Check 'Retest' in the third box on Line 37 of Data Sheet No. 3.

e. Fail - If the % Deviation (Line 36) is more negative than -1.0% , the boat fails the Live Load Capacity test. Check 'Fail' in the fourth box on Line 37 of Data Sheet No. 3.

f. Fail - If P_m (Line 21) is greater than P_2 (Line 34c), and if P_m (Line 21) is less than P_1 (Line 19), and if line 20 indicates that the boat either does not display stability warning labels, or does display stability warning labels that do not meet all of the

requirements of Paragraph 4.5.22.12, the boat fails the Live Load Capacity test. Check 'Fail' in the fifth box on Line 37 of Data Sheet No. 3.

If the boat must be retested proceed to Paragraph 4.5.2.18; otherwise, proceed to Paragraph 4.5.2.19.

4.5.2.18 Live Load Capacity Repeat Test --

- a. Repeat all test operations from Paragraphs 4.5.2.14 through 4.5.2.17a. Record all retest data in the right-hand set of blocks provided for this purpose on Data Sheet No. 3.
- b. If the % Deviation (Line 36) for the retest is greater than or equal to zero (0), check 'Pass' on Line 38 of Data Sheet No. 3.
- c. If the % Deviation (Line 36) for the retest is negative, check 'Fail' on Line 38 of Data Sheet No. 3.
- d. If the % Deviation (Line 36) for the retest lies between +1.0%, check the third box on Line 38 of Data Sheet No. 3 since the retest pass or fail condition lies within measurement of error.

If the First Test and Retest values differ by more than 1.0%, explain the reason for this difference by explaining the principal differences between the First Test data and the Retest data. Contact the USCG and explain the differences in the original test and the retest.

4.5.2.19 Equipment

See Paragraph 4.7.

4.6 Safe Loading Tests - Boats Rated for Manual Propulsion, and Boats Rated for Motors of Two Horsepower or Less

4.6.1 Requirements

4.6.1.1 Maximum Weight Capacity (W)

The Maximum Weight Capacity marked on boats rated for manual propulsion and boats rated for motors of 2 horsepower or less, excluding boats denoted in Para. 4.6.3.1 must not exceed three-tenths of the difference between the boat's Maximum Displacement and the Boat's Weight in pounds where:

- a. "Boat Weight" means the combined weight of the boat hull, deck, and superstructure and all its original and permanent appurtenances; and
- b. "Maximum Displacement" means the weight of the volume of water, measured in pounds, displaced by the boat at its maximum level immersion in calm water without major ingress of water.

* For this purpose a boat is considered level when it is transversely level and when either of the two following conditions are met:

- (i) The forward point where the sheer intersects the vertical centerline plane and the aft point where the sheer intersects the upper boundary of the transom (stern) are equidistant above the water surface or are equidistant below the water surface.
- (ii) The most forward point of the boat is level with or above the lowest point of water ingress.

4.6.1.2 Maximum Persons Capacity (P_1), Boats Rated for Manual Propulsion

Except as provided for in Paragraph 4.6.3.1, the Maximum Persons Capacity marked on boats rated for manual propulsion must be expressed in pounds and must not be greater than 90 percent of the Maximum Weight Capacity.

4.6.1.3 Maximum Persons Capacity (P_2), Boats Rated for Two or Less Horsepower

Except as provided for in Paragraph 4.6.3.1, the Maximum Persons Capacity marked on boats rated for motors of 2 horsepower or less must be expressed in pounds and not be greater than 90 percent of the Maximum Weight Capacity less 25 pounds.

4.6.2 Methods

4.6.2.1 Dimensional Measurement

- a. Place the boat on a boat trailer or chocks on a flat floor and trim the boat until the lowest point on the boat which is 40% of the boat's length aft of the forward most point on the boat is level with the lowest point on the boat which is 75% of the boat's length-aft of the forward most point of the boat. (Refer to Figure 2.)
* NOTE: Concrete floors are normally flat to within 1/4 inch. Flatness may be verified by use of a surveyor's level and rod placed on a two-foot grid pattern.
- b. Level the boat transversely by trimming it from side to side until corresponding points at either side of the transom are equal distance from the floor.
- c. Drop a plumb bob to the floor from the most forward part of the boat on centerline. Similary, drop a plumb bob at the aftermost part of the boat on centerline. Using a tape, measure the boat length (L) between the plumb bobs at the floor and record this value on Line 2 of Data Sheet No. 4.
* NOTE: If either the most forward point or aftermost point of the boat does not fall on centerline, use a string or straight edge to span the gap so that "L" represents the true maximum length as seen in profile.
- d. Check that length (L) is less than twenty (20) feet. If "L" equals or is greater than twenty (20) feet, terminate testing to the Safe Loading standard.

- e. Locate the point where the sheer intersects the vertical centerline plane of the boat at the forward end. Place the 45° indicating instrument in a vertical longitudinal plane on the boat's centerline and bring it into contact with the boat at the bow. Mark this point "S" (see Figure 2).

* NOTE: If the sheer intersects the vertical centerline plane of the boat at more than one point, the highest point of intersection will be marked as Point "S".

- f. Place the 45° indicating instrument in a series of vertical longitudinal planes across the boat's transom (stern) bringing the instrument into contact with the boat's transom (stern). Mark these points along the upper boundary of the transom (stern).

Mark Point(s) "T" at the intersection(s) of the sheer with the upper boundary of the transom.

* NOTE: If the sheer intersects the upper boundary of either side of the transom at more than one point, the highest point of intersection will be marked as "T".

- g. Seal minor leaks with waterproof tape or other suitable sealing media. Minor leaks include the hull/deck junction, handles, rivet holes, lifting eyes, etc. Vent holes shall not be sealed. Where controls pass through the hull or deck and a sealing boot is provided, minor leaks in the boot(s) shall be sealed. For outboard boats, one such motor well opening may be sealed when no boot is installed, provided its greatest dimension is not over three (3) inches and its purpose is for motor controls or fuel lines. Record any difficulties encountered in sealing the boat on Line 22 of Data Sheet No. 4.

* NOTE: Boats which are designed to be self-bailing shall have the self-bailing scuppers sealed prior to testing, regardless of the size of the openings.

4.6.2.2 Boat Weight

- a. Boat Weight (H) is the combined weight, in pounds, of the boat hull, deck, and superstructure and its original and permanent appurtenances. Determine the boat weight in accordance with the following paragraphs and record on Line 6 of Data Sheet No. 4.
- b. Suspend an inline dynamometer or a load cell with a full scale range not more than four times the weight of the boat from a crane hook and weigh and record the weight of all lifting apparatus such as strongback cables, straps, shackles, etc. Record on Line 5 of Data Sheet No. 4.
- c. Attach boat to lifting apparatus and weigh and record total weight of lifting apparatus plus the boat. Record on Line 4 of Data Sheet No. 4.
- d. Subtract the weight of the lifting apparatus from the total weight and record the gross weight of the boat (H) on Line 6 of Data Sheet No. 4.

4.6.2.3 Maximum Test Weight

Read the manufacturer's Maximum Weight Capacity (W_m) from the boat and record on Line 7 of Data Sheet No. 4. Calculate the Maximum Test Weight (MTW) in pounds using the following equation:

$$MTW = 3.33 W_m$$

$$= 3.33 \times \text{Line 7}$$

Record MTW on Line 8; and record 110% of MTW on Line 9 of Data Sheet No. 4.

4.6.2.4 Displacement Test

- a. Place the boat into the water by means of an overhead crane using nylon straps or equivalent around the hull to protect it from damage. To support the boat in case of inadvertent swamping, the straps may be attached to suitable points on the sides of the tank and left hanging loosely under the boat. Take care that the straps do not support the boat during the test. Place all machinery in its operating position.

- b. Carefully load the boat with lead bricks or other suitable weights (steel blocks or concrete blocks) placed on the floorboards until the MTW, as recorded on Line 8 of Data Sheet No. 4, is reached, or until the maximum displacement as defined in Paragraph 4.4.1.1 is reached.
- c. Place all weights as low in the boat as possible. If it is necessary to place weights on top of deck-over areas, use a fixture to transfer weight to the gunwale as shown in Figure 5. Record on Line 12 of Data Sheet No. 1 possible areas subject to damage by loading. Remove lights, chocks, flag staffs and other appurtenances which interfere with the proper placement of the fixture, (add weights to compensate for such removal).
- d. The amount of weight required to load the boat to MTW may be computed as 3.33 times the "Maximum Weight Capacity (persons, motor and gear)" taken from the manufacturer's capacity label. It is recommended that the weights be weighed to within $\pm 1\%$ and be labeled with that weight.

* NOTE: Proper care of the weights is essential. Steel blocks must be kept free of rust, and lead blocks be kept from abuse by dropping, or scraping. Periodic re-checking of the weights is recommended.
- e. As the weights are placed in the boat, each block's weight shall be recorded and a running total kept. When the boat has been loaded with weights until the waterline is 1 to $1\frac{1}{2}$ inches from the major point of water ingress and the MTW has not yet been reached, carefully add weights in decreasing increments (5#, 2#, 1#) distributing the weights so that the boat sinks with points "S" and "T" equal distance above or below the water surface.

CAUTION: Apply the last 10% of the weight slowly and evenly to avoid exceeding the MTW.

- f. If the most forward point of the boat is still above the water surface and it appears that a greater displacement might be reached by moving some weight forward, adjust the weights forward and continue adding weights in such a way that point "S" is lower than point "T", but the forwardmost point does not go below the water surface.
- g. The crane hook shall be left connected to a large weight near the center of the boat so that a substantial amount of weight may be removed quickly in case of inadvertent swamping. Care should be taken to maintain the crane cable slack so that it does not support or add to the weight during the test.
- h. Just before the boat starts to ship water, or when the MTW is reached, immediately stop adding weights, and pump out any water that enters the boat. Indicate on Line 22 of Data Sheet 4, where the point of major water ingress occurs.
- i. Proceed in accordance with (1) or (2) below, whichever is applicable.
 - 1) If the boat ships water before MTW is reached, proceed to Step j below.
 - 2) If MTW is reached prior to the boat shipping water, add additional weight until the boat ships water or until 110% of MTW is reached, whichever occurs first. Proceed in accordance with (2a) or (2b) below, whichever is applicable.
 - a) If the boat ships water before reaching 110% of MTW, proceed to Step j below.
 - b) If the boat still does not ship water when 110% of MTW is reached, measure the remaining freeboard and record on Line 10 of Data Sheet No. 4. Proceed to Step j below.

j. After all the weights have been placed in the boat, record the Total Test Weight, W_T , in pounds, on Line 11 of Data Sheet No. 4.

NOTE: To maintain ease in the handling and recording of the weights as they are placed in the boat, they should be divided into equal stacks. Each stack, for example, could contain 500 pounds. Other stacks, 100 pounds, for the final 10% of the MTW. This stack should have small increments of weight (i.e. 1, 2, and 5 lb blocks.) This would help double check the total weight placed in the boat. The testing facility would keep a running total of weight, and when the maximum weight is placed in the boat, a quick check of the stack would give an accurate verification of the weight used. When the weights are removed from the boat, another running total must be kept. This is then compared to W_T recorded on Line 11 of Data Sheet No. 4. If the difference between the two is greater than 2.0%, the test must be repeated with greater care given to the recording of the weights as they are placed in the boat.

k. After the test is complete, measure the amount of water in the boat that was not removed by the bilge pump. If this amount of water is greater than one gallon, the test must be repeated. Perform whatever operations are necessary to ensure that the bilge pump, or any supplementary pumps, can continuously maintain a dry boat (with at most one gallon of water in the boat) at all times during the displacement test. Repeat the displacement test from Paragraph 4.6.2.4a through Paragraph 4.6.2.4j, recording all data on Data Sheet No. 4 as First Test data. After successful displacement test has been performed, proceed to Paragraph 4.6.2.5.

NOTE: If it is necessary to use supplemental pumps to maintain a "dry" boat during this test, the weight of the pump and accessories should be recorded as part of the Total Test Weight used (Line 11 of Data Sheet No. 4).

4.6.2.5 Displacement, D - Using the Total Test Weight, W_T , which is recorded on Line 11 of Data Sheet No. 4, calculate the displacement, D, by using the following formula:

$$\begin{aligned}D &= W_T + H \\&= \text{Line 11} + \text{Line 6}\end{aligned}$$

Record the Displacement, D, on Line 12 of Data Sheet No. 4.

4.6.2.6 Maximum Weight Capacity, W_D - Using the Total Test Weight, W_T , which is recorded on Line 11 of Data Sheet No. 4, calculate the Maximum Weight Capacity, W_D , by using the formula:

$$\begin{aligned}W_D &= 0.30 [D - H] \\W_D &= 0.30 [(W_T + H) - H] \\&= 0.30 [(\text{Line 11} + \text{Line 6}) - \text{Line 6}] \\&= 0.30 [\text{Line 11}]\end{aligned}$$

Record W_D on Line 13 of Data Sheet No. 4. Note that if the boat did not ship water at or before 110% of MTW, the W_D is a fictitious Maximum Weight Capacity which is less than the actual Maximum Weight Capacity. However, subsequent use of W_D leads to the correct and desired result.

4.6.2.7 Maximum Weight Capacity, W - On Line 14 of Data Sheet No. 4, record the smaller of the following two values: W_m (Line 7) or W_D (Line 13). This value on Line 14 is the Maximum Weight Capacity, W.

4.6.2.8 Pass/Retest/Fail Criteria - Line 14 of Data Sheet No. 4 shows that displacement test can result in a pass condition, a retest condition, or a fail condition. Criteria for these three conditions are given below.

- a. % Deviation - The % Deviation between W_m (Line 7) and W_D (Line 13) is given by the formula:

$$\% \text{ Deviation} = 100 (W_D - W_m) / W_D$$

$$= 100 \times (\text{Line 13} - \text{Line 7}) / \text{Line 13}$$

Calculate the % Deviation, and record this value on Line 15 of Data Sheet No. 4.

- b. Pass - If Line 15 is positive (W_D is greater than W_m), and _____ is greater than two percent (2.0%), the boat passes the displacement test. Check 'Pass' on Line 16 of Data Sheet No. 4.
- c. Retest - If Line 15 lies between $\pm 2.0\%$ or is equal to either $\pm 2.0\%$, then a displacement retest is necessary since the test results lie within $\pm 2.0\%$ of W_m . Check 'Retest' on Line 16 of Data Sheet No. 4.
- d. Fail - If Line 15 is more negative than -2.0% (W_D is less than 98% of W_m), the boat fails the displacement test since the boat ships water before the manufacturer's Maximum Weight Capacity load is reached. Check 'Fail' on Line 16 of Data Sheet No. 4.

4.6.2.9 Repeat of Maximum Weight Capacity Test - Procedures set forth below are required only if Line 16 of Data Sheet No. 4 indicates that a repeat test is required; otherwise proceed to Paragraph 4.6.2.10. Repeat all test operations described in Paragraph 4.6.2.2 through Paragraph 4.6.2.7, and record all RETEST data in the right-hand RETEST boxes on the appropriate Line 4 through Line 15 of Data Sheet No. 4.

Calculate the % Deviation as described in Paragraph 4.6.2.8, and record this value on Line 15 of Data Sheet No. 4. Ignore the Pass/Retest/Fail criteria of Paragraph 4.6.2.8; and instead, use the following Pass/Fail criteria for the retest results:

- a. If Line 15 of Data Sheet No. 4 is greater than or equal to zero (0), check 'Pass' on Line 17 of Data Sheet No. 4.
- b. If Line 15 of Data Sheet No. 4 is negative, check 'Fail' on Line 17 of Data Sheet No. 4.
- c. If Line 15 lies between +1.0%, or is equal to +1.0%, check the third box of Line 17 of Data Sheet No. 4. This check indicates that the test boat passed or failed the test within the region of instrumentation error; that is, the difference between the manufacturer's Maximum Weight Capacity, W_m , and the calculated Maximum Weight Capacity, W , is within the 1.0% error of instrumentation used in the test.

If the First Test and Retest values on Line 15 differ by more than 1.0%, explain the reason for this difference by explaining the principal differences between the First Test data and the Repeat Test data. Contact the USCG and explain the differences in the original test and the retest and request permission to proceed with the test.

4.6.2.10 Maximum Persons Capacity, P_1 or P_2

- 1) Calculate the Maximum Persons Capacity using one of the following equations:

- a) For boats rated for manual propulsion:

$$\begin{aligned}P_1 &= 0.90 \times W \\&= 0.90 \times (\text{Line 13})\end{aligned}$$

- b) For boats rated for motors of two or less horsepower:

$$\begin{aligned}P_2 &= 0.90 \times W - 25.0 \\&= 0.90 \times (\text{Line 13}) - 25.0\end{aligned}$$

Record the Maximum Persons Capacity, P_1 or P_2 , on Line 18 of Data Sheet No. 4

4.6.3.1 Maximum Persons Capacity Exceptions (For Boats Assembled or Under Construction Before 1 August 1973)

The Maximum Persons Capacity marked on a boat may exceed the Maximum Persons Capacity, P , as calculated in 4.6.2.10, but not the Maximum Weight Capacity (w), provided the boat is also marked as follows:

- a. At least two waterproof labels permanently affixed so as to be conspicuous and readable from any normal boarding position.
- b. Each label consisting of a plan view of the boat and the words in block letters in the sizes shown in Figure 1, in colors that contrast with the background of the label.

Inspect the boat for the above warning labels properly applied and record the applicable condition on Line 19 of Data Sheet No. 4.

4.6.3.2 Persons Capacity in Whole Numbers of Persons

See Section 183.43 in Subpart C at the end of this test procedure.

4.7 Equipment and Materials List

<u>Item</u>	<u>Range</u>	<u>Accuracy</u>
Chocks or Boat Trailer	N/A	N/A
Plumb Bob	N/A	N/A
Tape Measure	0 - 25 ft	$\pm 1/4$ in.
Grease Pencil	N/A	N/A
Sealing Compound-Virginia Chemicals, Inc. "Prestite Permagum" or equal	N/A	N/A
Waterproof Tape - Arno "Ductape" - Arno Adhesive Tapes, Inc. Cat# 6504 C520 or equal	N/A	N/A
Vertical Upright Fixtures	(Heavy duty laboratory ring stands or similar hardware may be used for this purpose. Insure that the vertical rod is perpendicular to the floor.)*	
Dynamometer	1-1/2 to 4 times weight of boat	$\pm 1\%$
Platform Scale	0 - 700 lb	$\pm 1\%$
Nylon Straps (2)	6 in. x 20 ft.	-
Hoist	3 Ton	-
Tank	22 ft x 8 ft x 5 ft	N/A
Portable Electric Bilge Pump, 20 gpm Self priming		N/A

<u>Item</u>	<u>Range</u>	<u>Accuracy</u>
Weights	16,500 lb in 30 lb units or greater	$\pm 1\%$
Weights	75 lb in 5 lb units or smaller	± 0.1 lb
Lumber, 2 in. x 4 in. Fir cut as required	N/A	N/A
Styrofoam, 1 in. thick, cut as required	N/A	N/A
Masking Tape, 2 in. double sided	N/A	N/A
Hydrometer	1.000 - 1.070	± 0.001

* The base of the vertical upright fixtures shall include a spirit level.

5.0 TEST RECORDS AND REPORTS

5.1 Tapes and Recordings

5.1.1 Requirements - Permanent automated instrument record paper shall be utilized where automatic data recording is required and shall be identified with the test procedure number, date of test, specimen identification number as assigned by the test agency, applicable test procedure paragraph number, paper speed, zero position and scale factor.

5.1.2 Disposition - All automated instrument recordings shall be retained by the laboratory performing the test for a minimum period of three years or as directed by the USCG.

5.2 Reporting

5.2.1 Notice of Non-Conformance - Any indication of a non-conformance shall be communicated immediately by telephone to the Coast Guard Contract Monitor or his designated representative and followed up in writing within three working days after detection of any of the anomalies. This notice shall be submitted in writing using the form shown on the following page, and should be accompanied by photographs, sketches and copies of such possible test data as required to convey the nature and extent of the non-conformance.

The Notice of Non-Conformance shall be signed by the responsible test engineer signifying that the information and, if applicable, pictures, etc., are explanatory of the circumstances present at the time the anomaly was detected. In addition, the department manager or other responsible test agency officer shall sign the notice to signify that the circumstances and description provided in the notice are correct and represent the situation at hand.

A signature block has been provided for a Coast Guard test witness. The provisions for this signature are not mandatory but have been provided to allow complete documentation of a non-conformance if the Coast Guard test witness (monitor) is present during the inspection and elects to direct disposition of the test specimen. For example, "note all circumstances and continue the inspection", or "discontinue the inspection of the applicable specimens, and collect all data for Coast Guard review".

5.2.2 Compliance Test Data Sheets

5.2.2.1 Required Use - The Compliance Test Data Sheets included at the end of this section of the test procedure are mandatory for use in documenting the inspection and test data observed or recorded during the performance of test sequence outlined in this procedure.

NOTICE OF NON-CONFORMANCE

- Test Specimen Non-Conformance
- Test System or Other Out-of-Tolerance Condition

Job No.	_____
NC No.	_____
Contract No.	_____
Date	_____

To: _____

Attn: _____

Part Name _____ Serial No. _____

USCG No. _____ Specimen I.D. No. _____

Test _____

Test Procedure _____ Paragraph No. _____

Notification Made To: _____

Date _____ By _____ Via _____

Specification Requirements:

Description and Cause of Non-Conformance:

Specimen Disposition: _____

Comments - Recommendations:

USCG Test Witness: _____ Engineer: _____ (Signature)
Title: _____ Dept. Mgr. _____ (Signature)

5.2.2.2 Reproduction - The test data sheets have been designed to provide a standard means of identifying and reporting the test and inspection information required. Each test data sheet can be readily reproduced on any type of dry copier when more than one sheet is required for recording test results of a series of like specimens or the repetitive performance of any specific test. All entries on these Test Data Sheets shall be recorded in Black ink or Black type.

5.2.2.3 Standard Format - The test data sheets have been prepared to reflect the specific test data requirements outlined in this test procedure. The information on the forms has been standardized as much as possible paralleling the degree to which the procedures have been standardized. For example, all of the compliance test procedures require test specimen identification and receiving inspection. These requirements can be described on the forms in a standard format. Conversely, the type of tests to be performed and the results to be recorded differ from one test to the other, thus, necessitating provisions for different data sheet formats for each test.

5.2.2.4 Submission - It shall be the responsibility of the test agency to submit the completed Compliance Test Data Sheets to the Coast Guard in the final report unless otherwise directed.

5.2.3 Formal Test Report - A formal test report shall be prepared and submitted for USCG approval. Formal test reports shall contain the following major sections:

- a. Administrative data including Boating Safety Standard title and number, name of test laboratory, test laboratory report number or USCG task number, test article identification number, manufacturer's model number and serial number.
- b. Detail tabular and narrative results of each test including a complete presentation of any non-conformance, test anomalies, equipment problems, etc. The results shall explicitly state that the test article(s) did or did not meet the test requirements.
- c. Photographs of each test setup and any test article degradation that is detected.

All reports shall be signed by the report writer and shall have the notarized signature of a responsible test laboratory official.

DATA SHEET NO. 1
 SAFE LOADING STANDARD TEST PROCEDURE
 RECEIVING INSPECTION

1. Date: _____ Test Procedure No. _____
2. Specimen I. D. No. _____
3. Test Agency _____
4. Test Agency Job No. _____ Report No. _____
5. Nominal Length and Type of Boat _____ ft Inboard Outboard

 Stern Drive Other
6. Boat Mfg. Name _____
7. Boat Trade Name and/or Model No. _____
8. Engine Mfg. Name _____
9. Engine H.P. _____ Engine Model No. _____
10. Outdrive Mod. No. _____
11. Inventory of Other Accessories:

Qty	Description	Mfg.	Mod. No.

12. Description of Areas Which Might be Subject to Damage by Loading:

13. Receiving Inspection Results:

Signature

Date

Test Conductor

Witness

Approved

DATA SHEET NO. 2

SAFE LOADING TESTS -- OUTBOARD BOATS

RATED FOR OUTBOARD ENGINES LARGER THAN TWO HORSEPOWER
 (Throughout Data Sheet No. 2 and except as indicated, measure all lengths to ± 0.25 in., and measure all weights to $\pm 1.0\%$.)

1. Test Article I. D. No. _____ Test No. _____

2. Length, L (± 0.50 in.) _____ ft. _____

3. Check Test Option used: sheer points level most forward point rule

First Test	Retest
------------	--------

4. Weight of boat and lifting apparatus 1b. 1b.

5. Weight of lifting apparatus 1b. 1b.

6. Boat Weight, H = Line 4 - Line 5
 $= (\quad) - (\quad) =$
 $= (\quad) - (\quad) = :$

1b.	1b.
-----	-----

7. Manufacturer's Maximum Weight Capacity, W_m 1b.

8. Maximum Test Weight, MTW:
 $MTW = 5.0 \times W_m$
 $= 5.0 \times \text{Line 7}$
 $= 5.0 \times (\quad) =$
 $= 5.0 \times (\quad) =$

1b	1b.
----	-----

9. 110% of MTW = $1.10 \times \text{Line 8}$
 $= 1.10 \times (\quad) =$
 $= 1.10 \times (\quad) =$

1b	1b.
----	-----

10. Remaining freeboard if boat does not ship water before 110% of MTW: in. in.

11. Test Weight, W_T =
= () = 1b.
= () = 1b.

12. Displacement, $D = W_T + H$ =
= (Line 11) + (Line 6)
= () + () = 1b.
= () + () = 1b.

13. Maximum Weight Capacity, $W_D = 0.20 \times (W_T)$
= 0.20(Line 11)
= () 1b.
NOTE 1b.

W_D is fictitious if there exists any remaining freeboard after 110% of MTW.

14. Maximum Weight Capacity, W :

$W = \text{lesser of } W_m \text{ and } W_D$
= lesser of Line 7 and Line 13
= lesser of () and () = 1b.
= lesser of () and () = 1b.

15. Percent Deviation of Maximum Weight Capacity

% Deviation =
= $100 \times (W_D - W_m) / W_D$
= $100 \times (\text{Line 13} - \text{Line 7}) / \text{Line 13}$
= $100 \times (\quad - \quad) / (\quad) =$
= $100 \times (\quad - \quad) / (\quad) =$ %

16. Pass/Retest/Fail Criteria for First Displacement Test:

- Pass - If Line 15 (first test) is greater than + 2.0%
- Retest - If Line 15 (first test) lies between \pm 2.0% or is equal to either \pm 2.0%
- Fail - If Line 15 (first test) is more negative than - 2.0%

17. Pass/Fail Criteria for Displacement Retest:

- Pass - If Line 15 (retest) is greater than or equal to zero (0).
- Fail - If Line 15 (retest) is negative

Check this box if Line 15 (retest) lies between \pm 1.0% or is equal to either \pm 1.0%. This indicates that pass or fail condition lies within instrumentation error.

18. Maximum Persons Capacity, P_1 by W - Method

$$P_1 = W = \text{Line 14} =$$

1b.	1b.
-----	-----

Use only "retest" value on Line 14 if a displacement retest was conducted; otherwise use "first test" value.

19. Stability Warning Label:

- This boat does not stability warning labels.
- This boat does display stability warning labels that meet all the requirements of Paragraph 4.4.2.11.
- This boat does display stability warning labels, but they do not meet all of the requirements of Paragraph 4.4.2.11. Describe deficiencies on Line 39.

20. Machinery Weight (See table in Paragraph 4.4.2.12)

a. Motor and Control Weight

1b	1b
----	----

b. Battery Weight

1b	1b
----	----

c. Full Portable Fuel Tank Weight

1b	1b
----	----

d. Machinery Weight:

$$\text{Line 20a} + \text{Line 20b} + \\ \text{Line 20c} =$$

1b	1b
----	----

1b

21. Manufacturer's Maximum Persons Capacity, P_m
(From Manufacturer's Display of Capacity
Information)

22. Maximum Test Live Load, MTL:

$$\text{MTL} = 0.60 P_m = 0.60 \times \text{Line 21} \\ = 0.60 \times () =$$

1b

23. Specific gravity of test tank water

--	--

Safe Loading Tests, Outboard Boats.

24. Describe location of auxiliary fuel tank(s) and battery(s).
Use sketch if necessary.

25. Seat height, relative to floorboards, of seat
nearest geometric center of passenger compartment,
or of longer passenger compartment if two such
compartment exist.

in	in
----	----

Use Only for Boats With Two Passenger
Compartments

26. Seat height, relative to floorboard, of seat
nearest geometric center of shorter passenger
compartment.

in	in
----	----

27. Centerline length, L_c , of longer passenger
compartment; $L_c =$

in	in
----	----

28. Centerline length, L_S , of shorter passenger
compartment $L_S =$

in	in
----	----

29. Ratio $L_S / L_c =$ Line 28/ Line 27:

$$= (\quad) / (\quad) =$$

$$= (\quad) / (\quad) =$$

_____	_____
-------	-------

Use Only for Boats With Two Passenger Compartments

30. Test weight, T , placed in longer passenger compartment:

$$T = \frac{1}{1 + \frac{\text{Line 29}}{(\quad)}} \times \text{Line 22}$$

a) T (port side loading) =

1b	1b
1b	1b

b) T (starboard side loading) =

31. Test weight, T_s , placed in shorter passenger compartment:

a) Port Side Loading

$$T_s = (L_s/L) T$$

$$= \text{Line 29} \times \text{Line 30a}$$

$$= (\quad) \times (\quad) =$$

1b

$$= (\quad) \times (\quad) =$$

1b

b) Starboard Side Loading

$$T_s = (L_s/L) T$$

$$= \text{Line 29} \times \text{Line 30b}$$

$$= (\quad) \times (\quad) =$$

1b

$$= (\quad) \times (\quad) =$$

1b

32. Total test weight, A , used for side loading:

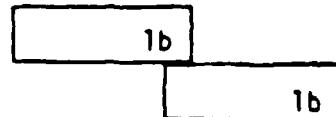
If the boat has two passenger compartments, use the following equations and record weight A ; otherwise, ignore the equations and record weight A in the appropriate box.

a) Port Side Loading

$$A = \text{Line 30a} + \text{Line 31a}$$

$$= () + () =$$

$$= () + () =$$

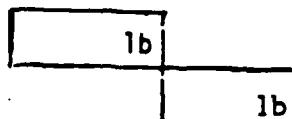


b) Starboard Side Loading

$$A = \text{Line 30} + \text{Line 31b}$$

$$= () + () =$$

$$= () + () =$$



33. Freeboard after 110% of MTL is applied

a. Port side loading (\approx 110% MTL)

1b	in	in
1b	in	in

b. Starboard side loading (\approx 110% MTL)

34. Maximum Persons Capacity, P_2 , by LLC Method:

a) Port Side Loading

$$P_2 = A/0.60 = 1.67 \times \text{Line 32a or Line 33a}$$

$$= 1.67 \times () =$$

$$= 1.67 \times () =$$

b) Starboard Side Loading

$$P_2 = A/0.60 = 1.67 \times \text{Line 32b or Line 33b}$$

$$= 1.67 \times () =$$

$$= 1.67 \times () =$$

c) Worst Side Loading

P_2 = Line 34a if only portside loading
is used

= Line 34b if only starboard side load-
ing is used

= lesser of Line 34a and 34b if both port and starboard side loading are used.

=

1b

1b

* NOTE: P_2 is fictitious if there exists any remaining freeboard after 110% MTL.

35. Maximum Allowable Persons Weight Capacity, P:

P = lesser of Line 18 and Line 34c

1b

1b

36. Percent Deviation of Maximum Persons Capacity Weight: NOTE: If 110% MTL was reached with freeboard remaining, ignore this line and check 'Pass' on Line 35.

% Deviation =

$$= 100 (P - P_m) / P$$

$$= 100 \times (\text{Line 35} - \text{Line 21}) / \text{Line 35}$$

$$= 100 \times (\quad - \quad) / (\quad) =$$

%

$$= 100 \times (\quad - \quad) / (\quad) =$$

%

:

37. Pass/Retest/Fail Criteria for First Live Load Capacity Test:



Pass - If Line 36 (First Test) is greater than 1.0%



Pass - If Line 21 is less than or equal to Line 14 (First Test), and 19 indicates that the boat meets all the requirements of Paragraph 4.4.2.11.



Retest - If Line 36 (First Test) lies between $\pm 1.0\%$ or is equal to either $\pm 1.0\%$.



Fail - If Line 36 (First Test) is more negative than -1.0% .



Fail - If Line 21 is greater than Line 34 (First

Test), and Line 21 is less than Line 18 (First Test), and Line 19 indicates that the boat either does not display stability warning labels, or does display stability warning labels that do not meet all of the requirements of Paragraph 4.4.2.11.

38. Pass/Fail Criteria for Live Load Capacity Retest:

► Pass - If Line 36 (Retest) is greater than or equal to zero (0).

► Fail - If Line 36 (Retest) is negative

Check this box if Line 36 (Retest) lies between, or is equal to, $\pm 1.0\%$. This indicates that the difference between the Manufacturer's Persons Capacity, P_m , is within measurement error.

39. Miscellaneous Comments

Miscellaneous Comments continued

Date

Test Conductor _____

Witness _____

Approved _____

DATA SHEET NO. 3

SAFE LOADING TESTS - INBOARD AND
INBOARD/OUTBOARD BOATS

Temp. _____

R. H. _____

Barometer _____

1. Test Article ID No. _____ Test No. _____

2. Length, L (\pm 0.50 in.) _____ ft _____3. Check Test Option Used: level sheer points
 most forward point rule

First Test	Retest
------------	--------

1b	1b
1b	1b

4. Weight of boat and lifting apparatus

Fuel Tank(s) (30 lb if not available from manufacturer)

1b	1b
----	----

TOTAL BOAT WEIGHT

1b	1b
----	----

5. Weight of lifting apparatus

1b	1b
----	----

6. Boat weight, H = Line 4 - Line 5

$$= () - () =$$

$$= () - () =$$

1b
1b

7. Machinery weight, M:

Engine(s) / motor(s)

1b

Control Equipment (15 lb if not available from Manufacturer)

1b

Battery(s) (45 lb if not available from Manufacturer)

1b

Other Machinery

1b	1b
----	----

TOTAL MACHINERY WEIGHT, M =

Throughout Data Sheet No. 3, and except as indicated, measure all lengths to \pm 0.25 in., and measure all weights to \pm 1.0%.

8. Manufacturer's Maximum Weight Capacity, W_m

1b

9. Maximum Test WEIGHT, MTW. The lesser value of either $MTW = 5.0 W_m + 4M$

$$= 5.0 \times \text{Line 8} + 4.0 \times \text{Line 7}$$

$$= 5.0 \times () + 4.0 \times () = \boxed{ } 1b$$

$$= 5.0 \times () + 4.0 \times () = \boxed{ } 1b$$

or

$$MTW = 7 \times W_m$$

$$= 7 \times \text{Line 8}$$

$$= 7 \times () = \boxed{ } 1b$$

$$= 7 \times () = \boxed{ } 1b$$

10. 110% of MTW = $1.10 \times$ the lesser value as determined in Line 9

$$= 1.10 \times ()$$

$$= 1.10 \times ()$$

1b

1b

11. Remaining freeboard if boat does not ship water before 110% of MTW.

:

in in

12. Test Weight, W_T

$$= ()$$

1b

$$= ()$$

1b

13. Displacement, $D = W_T + H$

$$= (\text{Line 12}) + (\text{Line 6}) =$$

$$= () + () = \boxed{ } 1b$$

$$= () + () = \boxed{ } 1b$$

14. Maximum Weight Capacity, W_D , by Displacement

Method: The greater value of either:

$$W_D = (0.20 \times W_T) - (0.80 \times M)$$

$$W_D = (0.20 \times \text{Line 12}) - (0.80 \times \text{Line 7})$$

$$= () - () =$$

$$= () - () =$$

1b

1b

OR

$$W_D = 0.143 \times [(W_T + H) - H]$$

$$= 0.143 \times [(\text{Line 12} + \text{Line 6}) - \text{Line 6}]$$

$$= 0.143 \times [\text{Line 12}] =$$

$$= 0.143 \times [\text{Line 12}] =$$

1b

1b

NOTE: W_D is fictitious if there exists any remaining freeboard after 110% of MTW.

15. Maximum Weight Capacity, W (W_D is the greater value determined in Line 14):

$$W = \text{The lesser of } W_m \text{ and } W_D$$

$$= \text{lesser of Line 8 and Line 14}$$

$$= \text{lesser of () and ()} =$$

$$= \text{lesser of () and ()} =$$

1b

1b

16. Percent Deviation of Maximum Weight Capacity :

$$= 100 \times (W_D - W_m) / W_D$$

$$= 100 \times (\text{Line 14} - \text{Line 8}) / \text{Line 14}$$

$$= 100 \times (-) / () =$$

$$= 100 \times (-) / () =$$

%

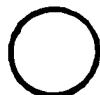
%

17. Pass/Retest/Fail Criteria for First Displacement Test:

- Pass - If Line 16 (First Test) is greater than $\pm 2.0\%$.
- Retest - If Line 16 (First Test) lies between $\pm 2.0\%$ or is equal to either $\pm 2.0\%$.
- Fail - If Line 16 (First Test) is more negative than -2.0% .

18. Pass/Fail Criteria for Displacement Retest:

- Pass - If Line 16 (Retest) is greater than or equal to zero (0)
- Fail - If Line 16 (Retest) is negative



Check this box if Line 16 (Retest) lies between $\pm 1.0\%$, or is equal to either $\pm 1.0\%$. This indicates that pass or fail condition lies within instrumentation error.

19. Maximum Persons Capacity, P_1 , by W - Method:

$$P_1 = W = \text{Line 15} =$$

1b	1b
----	----

Use only "retest" value on Line 15 if a displacement retest was conducted; otherwise use "first test" value.

20. Stability Warning Label:

- This boat does not display stability warning labels.
- This boat does display stability warning labels that meet all the requirements of Paragraphs 4.5.2.11.
- This boat does display stability warning labels, but they do not meet all of the requirements of Paragraph 4.5.2.11. Describe deficiencies on Line 39.

21. Manufacturer's Maximum Person Capacity, P_m (From Manufacturer's Display of Capacity Information)

1b

22. Maximum Test Live Load, MTL:

$$\begin{aligned} MTL &= 0.60 P = 0.60 \times \text{Line 21} \\ &= 0.60 \times () = \end{aligned}$$

1b

23. Specific gravity of test tank water

--	--

24. Describe location of auxiliary fuel tank(s) and battery(s).
Use sketch if necessary.

25. Seat height, relative to floorboards, of seat nearest geometric center of passenger compartment, or of longer passenger compartment if two such compartments exist.

in	in
----	----

Use Only for Boats With Two Passenger Compartment

26. Seat height, relative to floorboards, of seat nearest geometric center of shorter passenger compartment.

in	in
----	----

27. Centerline length, L , of longer passenger compartment; L

in	in
----	----

28. Centerline length, L_S , of shorter passenger compartment L_S =

in	in
----	----

29. Ratio L_S /L = Line 28/ Line 27

$$= (\quad) / (\quad)$$

30. Test weight, T , placed in longer passenger compartments:

$$T = \frac{1}{1 + \text{Line 29}} \times (\text{Line 22})$$

a) T (port side loading) =

1b	1b
1b	1b

b) T (starboard side loading) =

31. Test weight, T_S , placed in shorter passenger compartment:

a) Port Side Loading

$$T_S = (L_S / L) T$$

$$= \text{Line 29} \times \text{Line 30a}$$

$$= () \times () =$$

1b
1b

$$= () \times () =$$

b) $T_S = (L_S / L) T$

$$= \text{Line 29} \times \text{Line 30b}$$

$$= () \times () =$$

1b
1b

$$= () \times () =$$

32. Total test weight, A , used for side loading:

If the boat has two passenger compartments, use the following equations and record weight A ; otherwise, ignore the equations and record weight A in the appropriate box:

a) Port Side Loading

$$A = \text{Line 30} + \text{Line 31a}$$

$$= () + () =$$

1b
1b

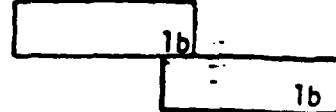
$$= () + () =$$

b) Starboard Side Loading

$$A = \text{Line 30b} + \text{Line 31b}$$

$$= (\quad) + (\quad) =$$

$$= (\quad) + (\quad) =$$



33. Freeboard after 110% of MTL is applied

Port side loading (\approx 110% MTL)

1b	in	in
1b	in	in

Starboard side loading (\approx 110% MTL)

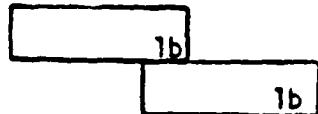
34. Maximum Persons Capacity, P_2 , by LLC Method:

a) Port Side Loading

$$P_2 = A/0.60 = 1.67 \times \text{Line 32a}$$

$$= 1.67 \times (\quad) =$$

$$= 1.67 \times (\quad) =$$

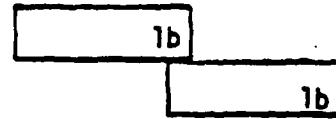


b) Starboard Side Loading

$$P_2 = A/0.60 = 1.67 \times \text{Line 32b}$$

$$= 1.67 \times (\quad) =$$

$$= 1.67 \times (\quad) =$$



c) Worst Side Loading

P_2 = Line 34a if only port side loading is used

= Line 34b if only starboard side loading is used

= lesser of Line 34a and 34b if both port and starboard side loading are used

=



NOTE: P_2 is fictitious if there exists any remaining freeboard after 110% MTL.

35. Maximum Allowable Persons Weight Capacity, P:

P = Lesser of Line 19 and Line 34c

1b	1b
----	----

36. Percent Deviation of Maximum Persons Capacity Weight:
NOTE: If 110% MTL was reached with freeboard remaining,
ignore this line and check 'Pass' on Line 36.

% Deviation =

$$= 100 (P - P_m) / P$$

$$= 100 \times (\text{Line 35} - \text{Line 21}) / \text{Line 35}$$

$$= 100 \times (\quad - \quad) / (\quad) = \boxed{\quad} \%$$

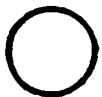
$$= 100 \times (\quad - \quad) / (\quad) = \boxed{\quad} \%$$

37. Pass/Retest/Fail Criteria for First Live Load Capacity Test:

- Pass - If Line 36 (First Test) is greater than 1.0%
- Pass - If Line 21 is less than or equal to Line 19 (First Test), and Line 21 is greater than Line 34 (First Test), and Line 20 indicates that the boat does display stability warning labels that meet all the requirements of Paragraph 4.5.2.12.
- Retest- If Line 36 (First Test) lies between \pm 1.0% or is equal to either \pm 1.0%
- Fail - If Line 36 (First Test) is more negative than -1.0%
- Fail - If Line 21 is greater than Line 34 (First Test), and Line 21 is less than Line 19 (First Test), and Line 20 indicates that the boat either does not display stability warning labels, or does display stability warning labels that do not meet all of the requirements of Paragraph 4.5.2.12.

38. Pass/Fail Criteria for Live Load Capacity Retest:

- Pass - If Line 36 (Retest) is greater than or equal to zero (0)
- Fail - If Line 36 (Retest) is negative



Check this box if Line 36 (Retest) lies between, or is equal to, $\pm 1.0\%$. This indicates that the difference between the Manufacturer's Persons Capacity, P_m , and the measured Maximum Allowable Persons Capacity, P , is within measurement error.

39. Miscellaneous Comments

Miscellaneous Comments continued

DATA SHEET NO. 4

Temp. _____

R. H. _____

AFE LOADING TESTS - BOATS RATED FOR MANUAL
PROPULSION, AND BOATS RATED FOR MOTORS OF Barometer _____
2 HORSEPOWER OR LESS

1. Test Article ID No. _____ Test No. _____

2. Length, L (\pm 0.50 in.) _____ ft _____3. Check test option used: level sheer points
 most forward point rule

4. Weight of boat and lifting apparatus

First Test _____ Retest _____

1b

1b

5. Weight of lifting apparatus

1b _____ 1b _____

1b

1b

6. Boat weight, H = Line 4 - Line 5

$$= () - () =$$

1b

$$= () - () =$$

1b

7. Manufacturer's Maximum Weight Capacity, W_m

1b _____

1b

8. Maximum Test Weight, MTW:

$$MTW = 3.33 W_m$$

$$= 3.33 \times \text{Line 7}$$

$$= 3.33 \times () =$$

1b

$$= 3.33 \times () =$$

1b

9. 110% of MTW = $1.10 \times$ Line 8

$$= 1.10 \times () =$$

1b

$$= 1.10 \times () =$$

1b

Throughout Data Sheet No. 4, and except as indicated, measure all length to \pm 0.25 in., and measure all weights to \pm 1.0%.

10. Remaining freeboard if boat does not ship water before 110% of MTW:

in	in
----	----

11. Test Weight, W_T =

$$= (\quad) =$$

1b

$$= (\quad) =$$

1b

12. Displacement, $D = W_T + H$

$$= (\text{Line 11}) + (\text{Line 6})$$

1b

$$= (\quad) + (\quad) =$$

$$= (\quad) + (\quad) =$$

1b

13. Maximum Weight Capacity, W_D

$$W_D = 0.30 \times [D - H]$$

1b

$$W_D = 0.30 \times [(W_T + H) - H]$$

$$= 0.30 \times [W_T]$$

$$= 0.30 \times [\text{Line 11}]$$

$$= (\quad) =$$

$$= (\quad) =$$

1b

NOTE: W_D is fictitious if there exists any remaining freeboard after 110% of MTW.

AD-A088 172

WYLE LABS HUNTSVILLE ALA EASTERN OPERATIONS

F/G 13/12

U.S. COAST GUARD SAFE LOADING STANDARD TEST PROCEDURE. (U)

DOT-CG-12377-A

JUN 80

USCG-B-002-80

NL

UNCLASSIFIED

202

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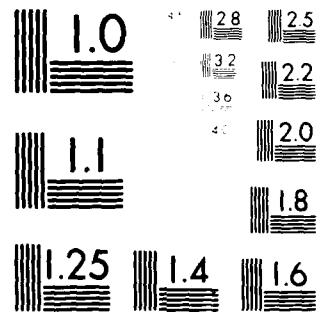
200

END

DATE FILMED

80

DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS

14. Maximum Weight Capacity, W:

$$W = \text{lesser of } W_m \text{ and } W_D$$

$$= \text{lesser of Line 7 and Line 13}$$

$$= \text{lesser of (} \quad \quad \text{) and (} \quad \quad \text{) } = \boxed{} \quad 1b.$$

$$= \text{lesser of (} \quad \quad \text{) and (} \quad \quad \text{) } = \boxed{} \quad 1b.$$

15. Percent Deviation of Maximum Weight Capacity:

$$\% \text{ Deviation} =$$

$$= 100 \times (W_D - W_m) / W_D$$

$$= 100 \times (\text{Line 13} - \text{Line 7}) / \text{Line 13}$$

$$= 100 \times (\quad \quad - \quad \quad) / (\quad \quad) = \boxed{} \% \quad 1b.$$

$$= 100 \times (\quad \quad - \quad \quad) / (\quad \quad) = \boxed{} \% \quad 1b.$$

16. Pass/Retest/Fail Criteria for Displacement Test:

► Pass - If Line 15 (First Test) is greater than + 2.0%

► Retest - If Line 15 (First Test) lies between $\pm 2.0\%$ or is equal to either

► Fail - If Line 15 (First Test) is more negative than - 2.0%

17. Pass/Fail Criteria for Displacement Retest:

► Pass - If Line 15 (Retest) is greater or equal to zero (0)

► Fail - If Line 15 (Retest) is negative



Check this box if Line 15 (Retest) lies between $\pm 1.0\%$, or is equal to either $\pm 1.0\%$. This indicates that pass or fail condition lies within instrumentation error

18. Maximum Persons Capacity, P_1 or P_2

a) For boats rated for manual propulsion:

$$P_1 = 0.90 \times W$$

$$= 0.90 \times \text{Line 13}$$

$$= 0.90 \times () =$$

$$= 0.90 \times () =$$

1b.

1b.

b) For boats rated for motors of two horsepower or less:

$$P_2 = 0.90 \times W - 25.0$$

$$= 0.90 \times \text{Line 13} - 25.0$$

$$= 0.90 \times () - 25.0 =$$

1b.

1b.

19. Stability Warning Label:

- This boat does not display Stability Warning Labels.
- This boat does display Stability Warning Labels that meet all the requirements of Paragraph 4.6.3.1.
- This boat does display Stability Warning Labels, but they do not meet all of the requirements of Paragraph 4.6.3.1. Describe deficiencies on Line 22.

20. Manufacturer's Maximum Persons Capacity, P_m (from manufacturer's Display of Capacity Information)

1b.

21. Specific Gravity of test tank water:

--	--

22. Miscellaneous Comments

Test Conductor _____ **Date** _____

Witness _____

Approval _____

SAFETY WARNING

DO NOT STAND

SIT IN MIDDLE

RED

RED

OPERATE WITH CARE

BOAT MAY OVERTURN

Dimensions

1/2"

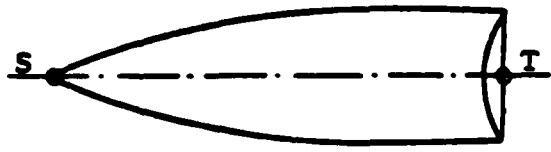
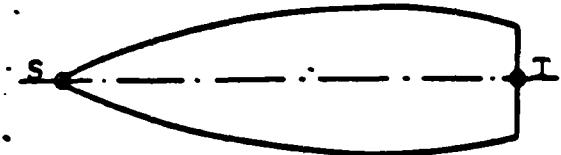
3/8"

1/2"

3/8"

3/8"

Figure 1. Stability Warning Label



Location of Point "T"
As Viewed from Bottom

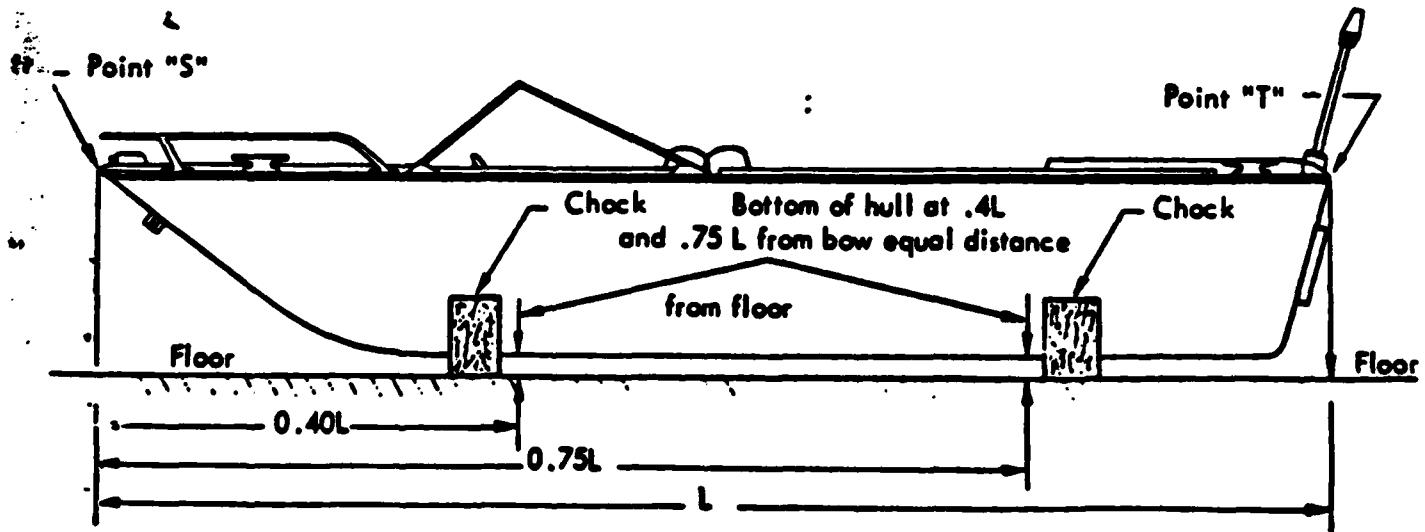


Figure 2. Determination of Length (L)

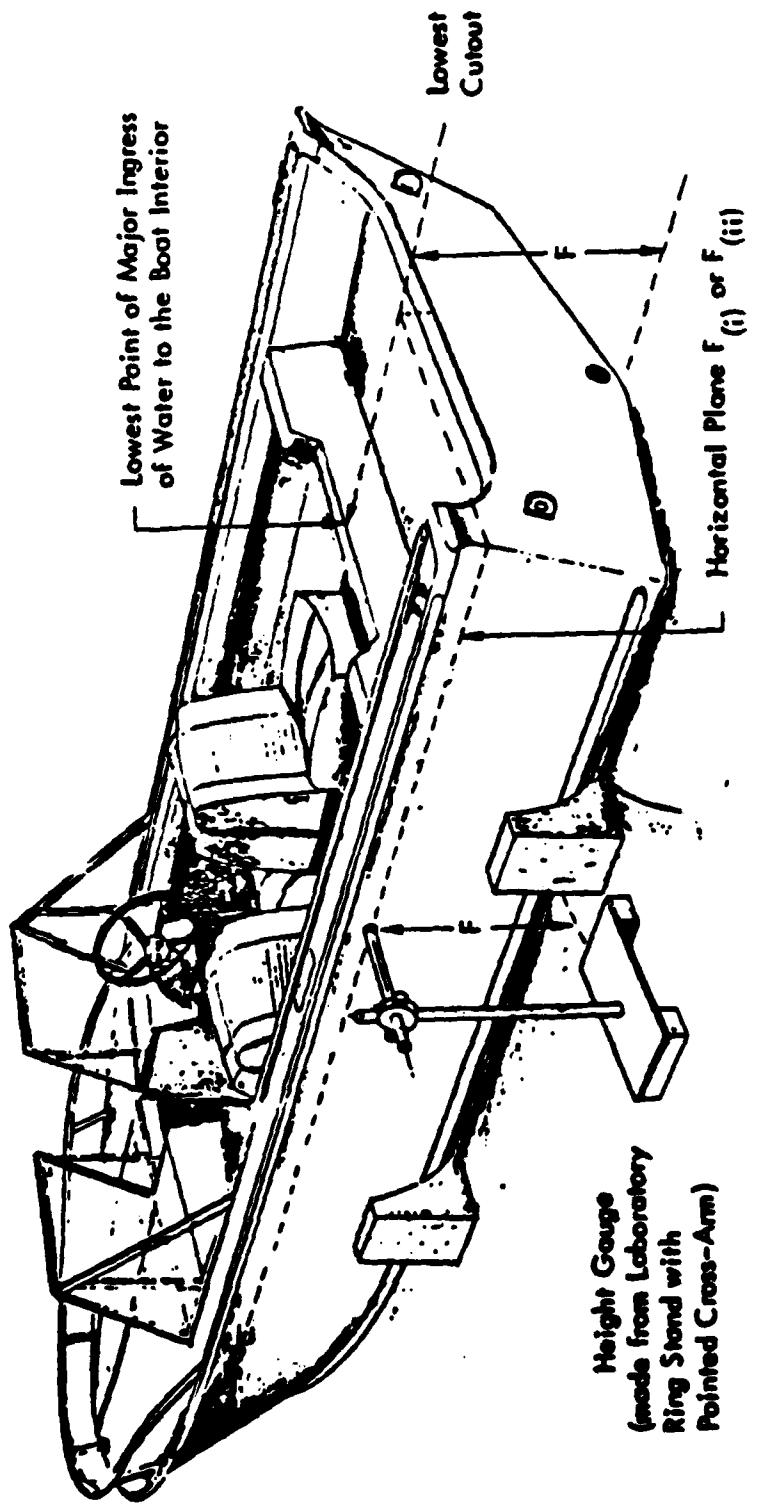


Figure 3. Location of Horizontal Plane F (i) or F (iii)

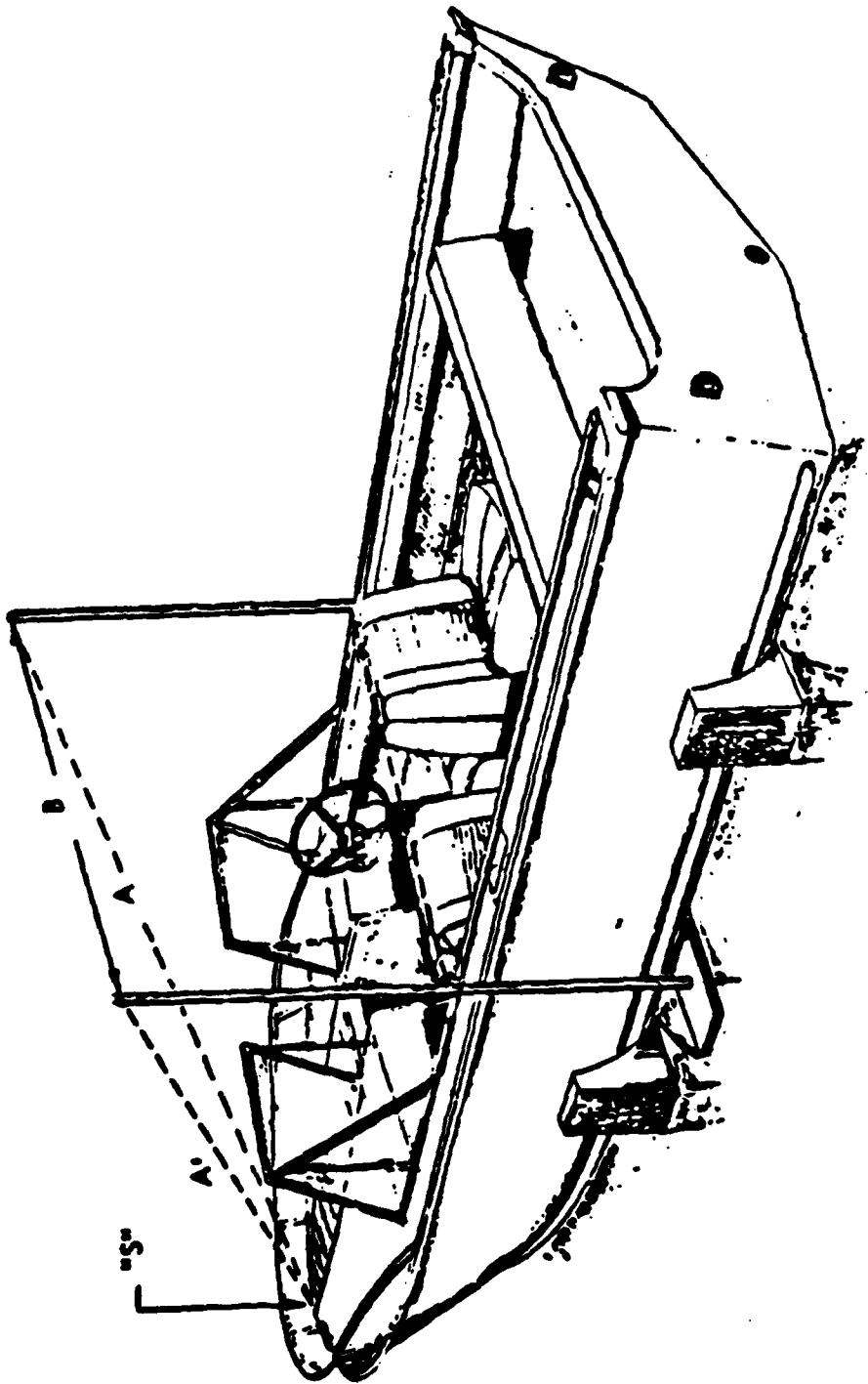
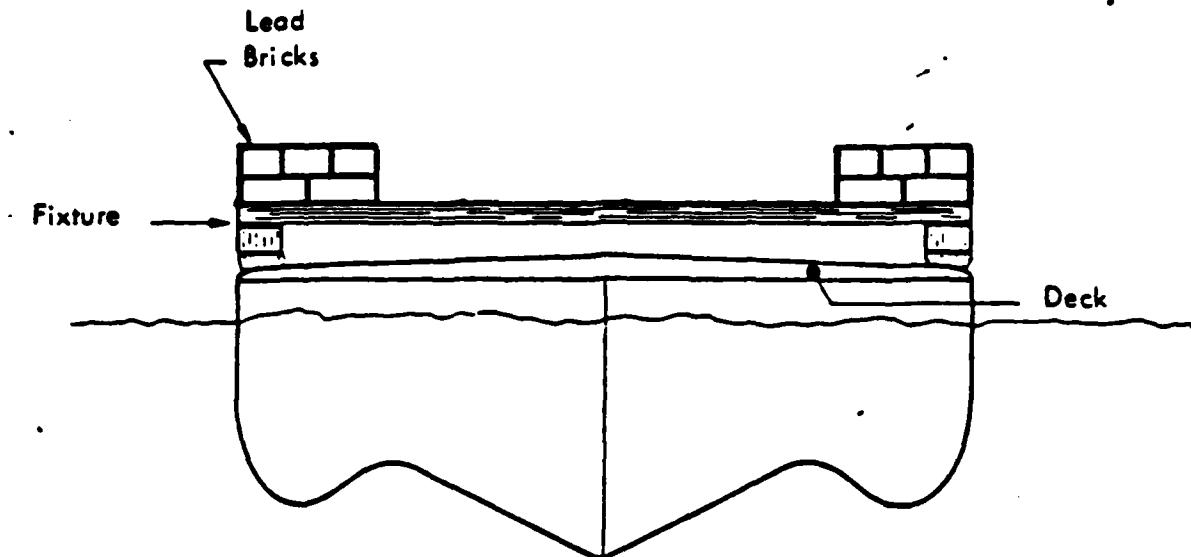
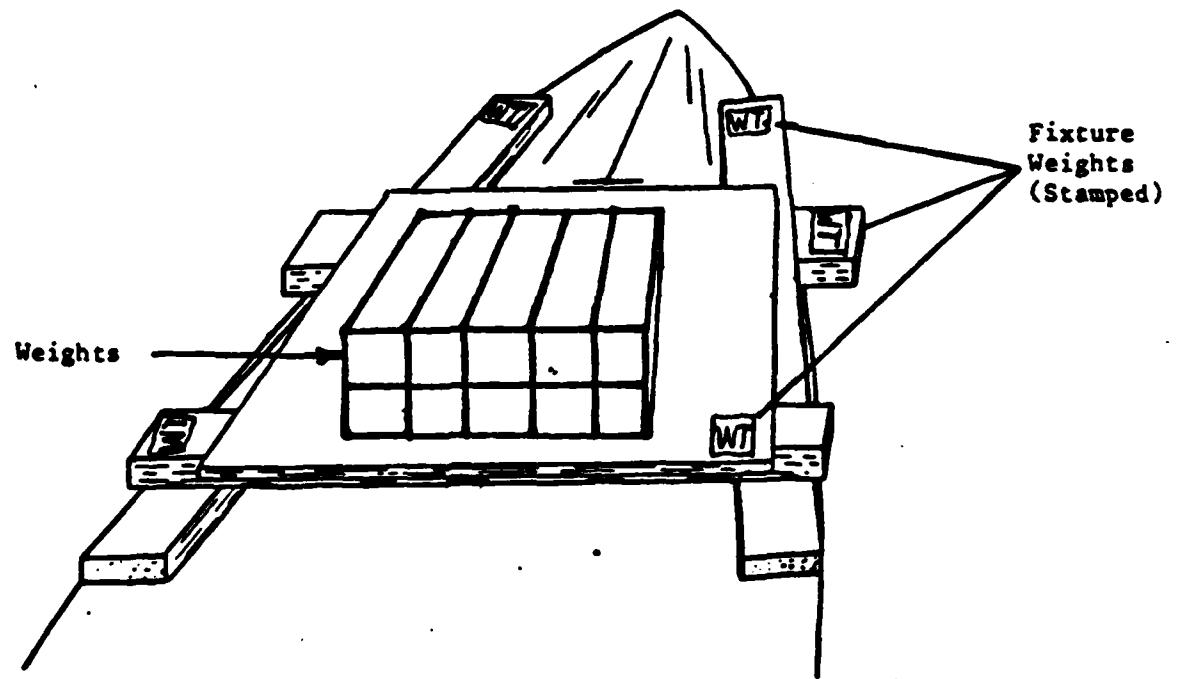


Figure 4. Measurement of the Beam



A. Proper Loading of Deck Fixture



B. Typical Deck Fixture

Figure 5. Construction and Use of Deck Fixture

TITLE 33—NAVIGATION AND Navigable Waters

CHAPTER I—COAST GUARD, DEPT. OF TRANSPORTATION

Subpart A—General

103.1 Purpose and applicability.

This part prescribes standards and regulations for boats and associated equipment to which § 12 of the Federal Boat Safety Act of 1971 applies and to which certification requirements in Part 101 of this subchapter apply.

103.3 Definitions.

(a) "Beam" means the transverse distance between the outer sides of the boat, excluding handles, and other similar fittings, attachments, and extensions.

(b) "Boat" means any vessel manufactured or used primarily for non-commercial use; leased, rented, or chartered to another for the latter's noncommercial use; or engaged in the carrying of six or fewer passengers.

(c) "Full transom" means a transom with a maximum width which exceeds one-half the maximum beam of the boat.

(d) "Length" means the straight line horizontal measurement of the overall length from the foremost part of the boat to the aftermost part of the boat, measured from end to end over the deck, excluding sheer, and measured parallel to the centerline. Bow sprits, bumpkins, rudders, outboard motor brackets, handles, and other similar fittings, attachments, and extensions are not included in the measurement.

(e) "Pontoon boat" means a boat on which the line of intersection of the water surface and the boat at any operating draft forms a single closed curve. For example, a catamaran, trimaran, or a pontoon boat is not a monohull boat.

(f) "Remote steering" means any mechanical assist device which is rigidly attached to the boat and used in steering the vessel, including but not limited to mechanical, hydraulic, or electrical control systems.

(g) "Sailboat" means a boat designed or intended to use sails as the primary means of propulsion.

(h) "Sheer" means the topmost line in a boat's side. This sheer intersects the vertical centerline plane of the boat at the forward end and intersects the transom (stem) at the aft end. For the purposes of this definition, the topmost line in a boat's side is the line defined by a series of points of contact with the boat structure, by straight lines at 45 degree angles to the horizontal and contained in a vertical plane normal to the outside edge of the boat as seen from above and which are brought into contact with the outside of the horizontal boat. A boat is horizontal when it is

transversely level and when the lowest points at 40 percent and 75 percent of the boat's length behind the most forward point of the boat are level.

(i) "Transom" means the surface at the stern of a boat protecting or lacking it. The upper boundary of the transom is the line defined by a series of points of contact, with the boat structure, by straight lines at 45 degrees angles to the horizontal and contained in a vertical longitudinal plane and which are brought into contact with the stern of the horizontal boat. A boat is horizontal when it is transversely level and when the lowest points at 40 percent and 75 percent of the boat's length behind the most forward point of the boat are level.

(j) "Vessel" includes every description of watercraft, other than a seaplane on the water, used or capable of being used as a means of transportation on the water.

(k) "Permanent appurtenances" means equipment that is mounted or fastened, so that it is not removable without the use of tools. Seats, inboard engines, windshields, helm stations, or hardtops are permanent appurtenances. Outboard motors, controls, batteries, and portable fuel tanks are not permanent appurtenances.

(49 CFR 1.46(h)(1)) [CGD 73-250, 40 FR 43056, Sept. 22, 1975, as amended by CGD 75-178, 42 FR 2881, Jan. 13, 1977]

EFFECTIVE DATE: The provisions of paragraph (k) of § 103.1 become effective July 22, 1977.

[CGD 73-250, 40 FR 43056, Sept. 22, 1975]

TITLE 33—NAVIGATION AND Navigable Waters

CHAPTER I—COAST GUARD, DEPT. OF TRANSPORTATION

Subpart B—Display of Capacity Information

103.21 Applicability.

This subpart applies to monohull boats less than 20 feet in length, except sailboats, canoes, kayaks, and inflatable boats.

103.23 Capacity marking required.

§ 103.23 Capacity marking required.
Each boat must be marked in the manner prescribed in § 103.25 and § 103.27 with the maximum persons capacity in whole numbers of persons and in pounds, the maximum weight capacity in pounds, determined under § 103.33 through 103.43, and the maximum horsepower capacity determined under § 103.53 or the statement "This Boat Not Rated for Operation by Motor".

U.S. Coast Guard Maximum Capacities

XX Persons or XXX Pounds

XXX Pounds, persons, gear

(3) For boats rated for motors of 2 horsepower or less:

U.S. Coast Guard Maximum Capacities

XX Persons or XXX Pounds

XXX Horsepower, motor

(4) For boats rated for manual propulsion:

U.S. Coast Guard Maximum Capacities

XX Persons or XXX Pounds

XXX Pounds, persons, gear

This Boat Not Rated for Propulsion by Motor

§ 103.26 Display of markings.

(a) Each marking required by § 103.23 must be permanently displayed in a legible manner where it is clearly visible to the operator when getting the boat underway.

(b) The information required by § 103.23 must be displayed in the following manner:

(1) For outboard boats:

U.S. Coast Guard Maximum Capacities
XX Persons or XXX Pounds

XXX Horsepower, motor

or

U.S. Coast Guard Maximum Capacities
XX Persons or XXX Pounds

XXX Pounds, persons, motor, gear

XXX Horsepower, motor with remote

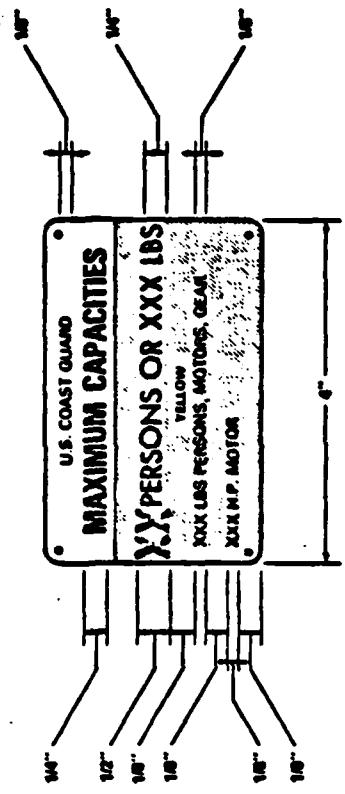
steering

XXX Horsepower, motor without remote

steering

(2) For inboard boats and inboard-

outboard boats:



All Dimensions Are Minimum

REGULATORY INFORMATION

§ 103.25 The capacity information required in § 103.23 must be displayed within a yellow area that—
(i) Is at least 4 inches wide; and
(ii) Is high enough that each line of print is separated by at least ½ inch from each other and from the borders of the yellow area;

(2) The persons capacity in whole numbers must be black print with the following dimensions:
(i) The height must not be smaller than one-half inch;
(ii) The width of the numbers must be three-fifths of the height except for the number "4," which shall be one stroke width wider, and the number "3," which shall be one stroke in width;

(iii) The stroke width shall be one-sixth of the height; and
(iv) The minimum space between the numbers shall be one stroke width.

(3) The words in the line "XX Persons or XXX Pounds" must be at least one-quarter inch in height but not larger than one-half the height of the persons capacity number and of a color contrasting with yellow. The number of pounds in this line must be at least one-eighth inch in height but no larger than one-half the height of the persons capacity number and of a color contrasting with yellow.

§ 103.27 Construction of markings.
Each marking required by § 103.23 must be—
(a) Capable of withstand the combined effects of exposure to water, oil, salt spray, direct sunlight, heat, cold, and wear expected in normal operation of the boat, without loss of legibility;

(b) Resistant to efforts to remove or alter the information without leaving some obvious sign of such efforts.

CHAPTER I—COAST GUARD, DEPT. OF TRANSPORTATION

Subpart C—Safe Loading

103.31 Applicability.

This subpart applies to monohull boats less than 20 feet in length except sailboats, canoes, kayaks, and inflatable boats.

103.33 Maximum weight capacity: Inboard and inboard-outdrive boats.

(a) The maximum weight capacity (W) marked on a boat that has one or more inboard or inboard-outdrive units for propulsion must not exceed the greater value of W obtained from either of the following formulas:

$$W = \frac{\text{Inboard displacement}}{6} - \frac{\text{boat weight}}{5} - \frac{\text{Machinery weight}}{5}$$
$$\quad \quad \quad \text{or}$$
$$W = \frac{\text{Inboard displacement} - \text{boat weight}}{7}$$

(b) For the purpose of paragraph (a) of this section—

(i) "Maximum displacement" is the weight of the volume of water displaced by the boat at its maximum level immersion in calm water without water coming aboard. For the purpose of this paragraph, a boat is level when it is transversely level and when either of the two following conditions are met:

(i) The forward point where the sheer intersects the vertical centerline plane and the aft point where the sheer intersects the upper boundary of the transom (stern) are equidistant above the water surface or are equidistant below the water surface.

(ii) The most forward point of the boat is level with or above the lowest point of water ingress.

(2) "Boat weight" is the combination of:

- (i) Hull weight;
- (ii) Deck and superstructure weight;
- (iii) Weight of permanent appurtenances; and
- (iv) Weight of full permanent fuel tanks.

(3) "Machinery weight" is the combined weight of installed engines or motors, control equipment, drive units, and batteries.

(4) "Inboard weight" is the combined weight of two motors of two horsepower or less.

TITLE 33—NAVIGATION AND NAVIGABLE WATERS

103.35 Maximum weight capacity: Outboard boats.

(a) The maximum weight capacity marked on a boat that is designed or intended to use one or more outboard motors for propulsion must be a number that does not exceed one-tenth of the difference between its maximum displacement and boat weight.

(b) For the purposes of paragraph (a) of this section—

(1) "Maximum displacement" is the weight of the volume of water displaced by the boat at its maximum level immersion in calm water without water coming aboard except for water coming through one opening in the motor well with its greatest dimension not over 3 inches for outboard motor controls or fuel lines. For the purpose of this paragraph, a boat is level when it is transversely level and when either of the two following conditions are met:

(i) The forward point where the sheer intersects the vertical centerline plane and the aft point where the sheer intersects the upper boundary of the transom (stern) are equidistant above the water surface or are equidistant below the water surface.

(ii) The most forward point of the boat is level with or above the lowest point of water ingress.

(2) "Boat weight" is the combination of:

- (i) Hull weight;
- (ii) Deck and superstructure weight;
- (iii) Weight of permanent appurtenances; and
- (iv) Weight of full permanent fuel tanks.

(40 CFR 1.46(a)(11)) CGD 72-61R, 37 FR 15782, Aug. 4, 1972, as amended at 39 FR 10899, Mar. 22, 1974; CGD 74-62, 40 FR 33973, Aug. 13, 1975; CGD 75-176, 40 FR 43057, Sept. 23, 1975; CGD 74-63, 40 FR 51440, Nov. 5, 1975; CGD 75-178, 42 FR 2681, Jan. 13, 1977

103.37 Maximum weight capacity: Boats rated for manual propulsion and boats rated for motors of two horsepower or less.

(a) The maximum weight capacity marked on a boat that is rated for manual propulsion or for motors of two horsepower or less must not exceed 3/10 of the difference between the boat's maximum displacement and the boat's weight in pounds.

(b) For the purposes of paragraph (a) of this section—

(1) "Maximum displacement" is the weight of the volume of water displaced by the boat at its maximum level immersion in calm water without water coming aboard. For the purpose of this paragraph, a boat is level

(40 CFR 1.46(a)(11)) CGD 72-61R, 37 FR 15782, Aug. 4, 1972, as amended at 39 FR 10899, Mar. 22, 1974; CGD 74-62, 40 FR 33973, Aug. 13, 1975; CGD 75-176, 40 FR 43057, Sept. 23, 1975; CGD 74-63, 40 FR 51440, Nov. 5, 1975; CGD 75-178, 42 FR 2681, Jan. 13, 1977

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when it is transversely level and when either of the two following conditions are met:

(i) The forward point where the sheer intersects the vertical centerline plane and the aft point where the sheer intersects the upper boundary of the transom (stern) are equidistant above the water surface or are equidistant below the water surface.

(ii) The most forward point of the boat is level with or above the lowest point of water ingress.

(2) "Boat weight" is the combination of:

- (i) Hull weight;
- (ii) Deck and superstructure weight; and
- (iii) Weight of permanent appurtenances.

(45 CFR 1.384(h)) CGD 72-61R, 37 FR 15722, Aug. 4, 1972, as amended at 39 FR 10000, Mar. 22, 1974; CGD 73-250, 40 FR 42657, Sept. 23, 1975; CGD 75-176, CGD 74-268, 42 FR 3031-3032, Jan. 13, 1977.

183.39 Persons capacity: Inboard and inboard-outdrive boats.

(a) The persons capacity in pounds marked on a boat that is designed or intended to use one or more inboard engines or inboard-outdrive units must not exceed the lesser of—
(i) The maximum weight capacity determined under § 183.33 for the boat;

(ii) Fleet the boat in calm water with all its permanent appurtenances, including installed engines, full fuel system and tanks, control equipment, drive units and batteries.

(ii) Gradually add weights along one outboard extremity of each passenger carrying area, at the height of the seat nearest the center of that area, but no higher than the height of the gunwale and distributed equally forward and aft of that center in a plane parallel to the floorboards until the boat assumes the maximum list or trim, or both without water coming aboard.

(iii) Gradually add weights along one outboard extremity of each passenger carrying area, at the height of the seat nearest the center of that area, but no higher than the height of the gunwale and distributed equally forward and aft of that center in a plane parallel to the floorboards until the boat assumes the maximum list or trim, or both without water coming aboard.

(iv) Compute the persons capacity in pounds using the following formula:
Persons capacity = $A/0.6$ where A is the total of the weights added in paragraph (e)(2)(iii) of this section.

(b) The maximum persons capacity in whole numbers of persons marked on a boat designed or intended to use one or more outboard motors for propulsion must not exceed the value obtained by adding 32 pounds to the lesser of the values determined in paragraph (e)(1) or (e)(2)(iv), dividing the sum by 141, and rounding off the result to the nearest whole number. If the fraction is less than one-half, round down to the next lower whole integer and if the fraction is equal to or greater than one-half, round up to the next higher whole integer.

(c) The maximum persons capacity in whole numbers of persons marked on a boat rated for motors of 2 horsepower or less must not exceed—

(1) For boats rated for manual propulsion, 80 percent of the maximum weight capacity in pounds;

(2) For boats rated for motors of 2 horsepower or less, 90 percent of the maximum weight capacity in pounds, less 25 pounds.

(d) The maximum persons capacity in whole numbers of persons marked on a boat that is rated for manual propulsion must not exceed the value obtained by adding 32 pounds to the value determined in paragraph (e)(2), dividing the sum by 141, and rounding off the result to the nearest whole number. If the fraction is less than one-half, round down to the next lower whole integer and if the fraction is equal to or greater than one-half, round up to the next higher whole integer.

TITLE 33—NAVIGATION AND Navigable Waters

183.41 Persons capacity: Outboard boats.

(a) The persons capacity in pounds marked on a boat that is designed or intended to use one or more outboard motors for propulsion must not exceed the lesser of—

(i) The maximum weight capacity determined under § 183.33 for the boat minus the motor and control weight, battery weight (dry), and full portable fuel tank weight from table 4 of Subpart H of this Part; or

(ii) The maximum persons capacity in pounds determined by the following test in calm water:

(i) Float the boat with all its permanent appurtenances.
(ii) Add, in normal operating position, the dry motor and control weight, battery weight, and full portable fuel tank weight, if any, shown in table 4 of Subpart H of this Part for the maximum horsepower capacity marked on the boat. [Permanently installed fuel tanks shall be full of fuel.]

(b) The maximum persons capacity in pounds marked on a boat that is rated for manual propulsion or inboard-outdrive units must not exceed the value obtained by adding 32 pounds to the result of the following formula: Persons capacity = $A/0.6$ where A is the total of the weights added in paragraph (e)(2)(iii) of this section.

(c) The maximum persons capacity in whole numbers of persons marked on a boat that is designed or intended to use one or more inboard engines or inboard-outdrive units must not exceed the value obtained by adding 32 pounds to the value determined in paragraph (e)(2)(iii), dividing the sum by 141 and rounding off the result to the nearest whole number. If the fraction is less than one-half, round down to the next lower whole integer and if the fraction is equal to or greater than one-half, round up to the next higher whole integer.

(d) The maximum persons capacity in whole numbers of persons marked on a boat rated for motors of 2 horsepower or less must not exceed the value obtained by adding 32 pounds to the value determined in paragraph (e)(2), dividing the sum by 141, and rounding off the result to the nearest whole number. If the fraction is less than one-half, round down to the next lower whole integer and if the fraction is equal to or greater than one-half, round up to the next higher whole integer.